STAR

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PUBLIC DOCUMENTS

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INTRODUCTION

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Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. **793**

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Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology. **798**

05 BIOTECHNOLOGY
Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences. **804**

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Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation. **812**

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Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbits and trajectories. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles. 944

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TYPICAL CITATION AND ABSTRACT FROM *STAR*

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NASA ACCESSION NUMBER
N71-10429* # Lockheed Missiles and Space Co., Sunnyvale, Calif.
CORPORATE SOURCE
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LIMITATIONS IN THERMAL MODELING Technical Summary Report, 6 Jun. 1967 – 8 Dec. 1969
PUBLICATION DATE
AUTHORS
R. E. Rolling, D. O. Murray, and K. N. Marshall Dec. 1969
245 p refs
(Contract NAS8-21153)
AVAILABILITY SOURCE
(NASA-CR-102566; LMSC-6-78-69-41) Avail: NTIS CSCL 20M
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COSATI CODE
An analytical and experimental study was made of the possible limitations existent in utilizing small-scale models for determination of spacecraft thermal behavior. A potential limitation in scale factor, experimental accuracy, and accuracy in model design is associated with each spacecraft design. Individual problem areas of thermal modeling are treated separately. Author
REPORT NUMBER

VOLUME 9 NUMBER 6 / MARCH 23, 1971

Scientific and Technical Aerospace Reports

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01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N71-15701# National Physical Lab., Teddington (England). Aerodynamics Div.

ON ACHIEVING INTERFERENCE-FREE RESULTS FROM DYNAMIC TESTS ON HALF-MODELS IN TRANSONIC WIND TUNNELS

A. W. Moore and K. C. Wight London Aeron. Res. Council 1970 32 p refs Supersedes NPL-AERO-1293; ARC-31049

(ARC-R/M-3636; NPL-AERO-1293; ARC-31049) Copyright. Avail: NTIS; HMSO: 80p; BIS: $3.20

An interference-free datum for oscillatory pitching derivatives was deduced from tests on a small half-model in three ventilated tunnels. The large dynamic interference in a smaller slotted tunnel was reduced to small proportions at all speeds when perforated screens were fitted behind the slots. Corrected results for side-wall boundary layer effects agreed with measurements made with the boundary layer thinned locally by vortex generators. Author (ESRO)

N71-15702# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

A LOW-SPEED WIND-TUNNEL INVESTIGATION OF THE TAILPLANE EFFECTIVENESS OF A MODEL REPRESENTING THE AIRBUS TYPE OF AIRCRAFT

D. A. Lovell London Aeron. Res. Council 1970 44 p refs Supersedes RAE-TR-69077; ARC-31507

(ARC-R/M-3642; RAE-TR-69077; ARC-31507) Copyright. Avail: NTIS; HMSO: £1.10; BIS: $4.05

Lift, drag, and pitching moment measurements were made on a model having three tailplane heights and three wing configurations, with and without the tailplane in position. Wake and boundary-layer surveys at the tailplane heights and a separate force and moment test of the isolated tailplane were also made. The tailplane efficiency was determined for the three tailplane heights. The interference involved in mounting the tailplane on the model was negligible with the tailplane mounted away from the body. With the tailplane mounted on the large body the interference was small and no evidence of extensive flow separation was found. Author (ESRO)

N71-15703# National Physical Lab., Teddington (England). Aerodynamics Div.

THEORETICAL LIFT-DEPENDENT YAWING MOMENT ON A SWEPT WING IN SUBSONIC FLOW WITH SPANWISE ASYMMETRY

H. C. Garner Jan. 1970 16 p refs

(NPL-AERO-NOTE-1084; ARC-31757) Copyright. Avail: NTIS

Classical lifting-line theory shows that the yawing moment should depend only on the spanwise loading but application to a tapered swept wing at incidence with linear antisymmetrical twist gives values 60% in excess with correct total drag. When the static twist is replaced by an equivalent steady rolling motion to give the same wing loading, the yawing moment has different sign and is underestimated by 50% if the simpler theoretical approach is used. Author (ESRO)

N71-15704# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).

EXPERIMENTAL INVESTIGATION OF FORCES ON SIMPLE LIFTING BODIES IN RAREFIED HYPERSONIC FLOW [EXPERIMENTELLE UNTERSUCHUNG DER KRAEFTE AN EINFACHEN FLUGKOERPERN BEI VERDUENNTER HYPERSCHALLSTROEMUNG]

G. Koppenwallner Jul. 1970 43 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.

(BMBW-FB-W-70-41) Avail: NTIS; ZLDI Munich: 8.80 DM

Force measurements on cones, cone-cylinders, an integral Junkers lifting body, and a sharp edged delta wing were carried out in a hypersonic low density wind tunnel. Mach numbers ranged from 7 to 22 with gas stagnation temperatures from 300 K to 1600 K. The simulated Reynolds number range was in the slip flow region. The construction and calibration of a water-cooled three component strain-gage balance is described. Author (ESRO)

N71-15705# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.

A FORM OF LATERAL INSTABILITY OF LIFTING FREE-FLIGHT MODELS TOWED BY A HELICOPTER

W. J. G. Pinsker London Aeron. Res. Council 1970 18 p refs Supersedes RAE-TR-68247; ARC-31273

(ARC-R/M-3841; RAE-TR-68247; ARC-31273) Copyright. Avail: NTIS; HMSO: 45p; BIS: $1.80

Experiments on unstable lateral pendular oscillations when towed above a certain speed are described. A mathematical model, considering only roll angle and lateral displacement of the model, gave results in agreement with flight observation. Critical speed prediction is discussed along with design parameters for increasing the speed range in which stable tow is possible. Author (ESRO)

N71-15706# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

LOW-SPEED WIND-TUNNEL TESTS ON A WING SECTION

WITH PLAIN LEADING- AND TRAILING-EDGE FLAPS HAVING BOUNDARY-LAYER CONTROL BY BLOWING

J. A. Lawford and D. N. Foster London Aeron. Res. Council 1970 36 p refs Supersedes RAE-TR-69078; ARC-31371
(ARC-R/M-3639; RAE-TR-69078; ARC-31371) Copyright. Avail: NTIS; HMSO: 90p; BIS: $3.50

The tests were made in almost two dimensional conditions and the increases of lift were measured for a range of flap deflections. The effectiveness of a leading edge flap for increasing the stalling incidence and maximum lift coefficient was also studied. Inviscid theory pressure distribution predictions agreed with the data and suggest that minimum aerodynamic drag occurs when the inviscid lift is achieved. Author (ESRO)

N71-15707# National Physical Lab., Teddington (England). Aerodynamics Div.

EXPERIMENTAL VERIFICATION OF PREDICTED STATIC HOLE SIZE EFFECTS ON A MODEL WITH LARGE STREAMWISE PRESSURE GRADIENTS

P. G. Pugh, J. W. Peto, and L. C. Ward Feb. 1970 19 p refs
(NPL-AERO-1313; ARC-31900) Copyright. Avail: NTIS

Spherically-blunted cone surface pressure data are used to demonstrate a simple method for correcting finite static hole size effects over the spherical portion of the model. Author (ESRO)

N71-15708# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.

TESTS AT A MACH NUMBER OF 2.0 ON A RECTANGULAR, TWIN-DUCT AIR INTAKE WITH VARIABLE GEOMETRY, SITUATED IN THE FLOW FIELD OF A SLENDER WING

M. D. Dobson London Aeron. Res. Council 1970 40 p refs Supersedes RAE-TR-68285; ARC-31118
(ARC-CP-1122; RAE-TR-68285; ARC-31118) Copyright. Avail: NTIS; HMSO: 50p; BIS: $2.00

The intake performance was assessed in a wind tunnel and effects in one duct, due to flow variations through the other, were also investigated. Partial immersion of the intake into a wing boundary layer caused little performance degradation and even small increases of pressure recovery were noted. Interference effects may be sensitive to small crossflow angles at the intake. Smaller margins of mass flow reduction without interference were observed when the windward duct was throttled. The design of the leading edge of the wall which separates the two ducts (splitter), affected the interference characteristics. Author (ESRO)

N71-15827*# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.

A NUMERICAL SOLUTION OF THE UNSTEADY AIRFOIL WITH APPLICATION TO THE VORTEX INTERACTION PROBLEM

Wylie E. Rudhman Dec. 1970 89 p refs
(Grant NGR-39-009-111)
(NASA-CR-111843) Avail: NTIS CSCL 20D

A numerical method to predict the aerodynamic forces acting on a thin airfoil operating in an unsteady potential flow is developed. A distribution of discrete point vortices placed on an arbitrary camber line represents the airfoil. The time dependent solution including wake generation is obtained starting with the system at rest. A rigid wake assumption is used where the wake vortices lie in the direction of the chord line and move with the free stream velocity. The results of the numerical solution are shown to agree with results using the classic theories of Theodorsen for the oscillating airfoil and of Wagner for the impulsively started airfoil. Using the numerical method, a parametric study is conducted to determine the time history of the loads on an airfoil produced by a vortex passing in proximity to the airfoil. Results of the study are compared to an experimental investigation of the rotor blade-vortex interaction problem. Author

N71-16533*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EXPERIMENTAL AERODYNAMIC PERFORMANCE CHARACTERISTICS OF A ROTOR ENTRY VEHICLE CONFIGURATION. 1: SUBSONIC

Ronald C. Smith and Alan D. Levin Washington Feb. 1971 43 p refs
(NASA-TN-D-7046; A-3709) Avail: NTIS CSCL 01C

Wind tunnel tests were conducted to determine the aerodynamic performance characteristics of an unpowered rotor entry vehicle configuration at Mach numbers of 0.3 and 0.7. Rotor blade configurations having double wedge and modified ellipse profiles were tested at vehicle angles of attack from 15 to 90 deg. The ellipse profile was tested for rotor diameters of 45 and 60 inches. Variable blade collective pitch was used to control rotor rotational speed. It was found that the rotor had an unstable operating range at tunnel speeds up to M = 0.3 for the low-angle glide attitudes. At higher speeds, manual control of rotor RPM was simple and straightforward. Test results indicate that the rotor produced destabilizing pitching moments putting the test configuration out of longitudinal trim in glide attitude. At M = 0.3 the maximum lift-drag ratio was about 2.6 for the long-blade configuration, and 1.8 for both short-blade configurations. At M = 0.7 the maximum lift-drag ratio was 1.1 for all the test configurations. Author

N71-16534*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EXPERIMENTAL AERODYNAMIC PERFORMANCE CHARACTERISTICS OF A ROTOR ENTRY VEHICLE CONFIGURATION. 2: TRANSONIC

Alan D. Levin and Ronald C. Smith Washington Feb. 1971 46 p refs
(NASA-TN-D-7047; A-3710) Avail: NTIS CSCL 01C

Wind tunnel tests were conducted to determine the aerodynamic performance characteristics of an unpowered rotor entry vehicle configuration at Mach numbers from 0.91 to 1.11. Blade collective pitch angle was varied for model angles of attack from 15 to 90 deg. The effectiveness of cyclic pitch controls at 15 and 25 deg angle of attack was also tested. Rotor blade configurations having double wedge and modified ellipse profiles were tested in combination with a 15-inch diameter capsule forebody. The ellipse profile was tested for rotor diameters of 45 and 60 inches. It was found that neither blade-section shape nor Mach number had significant effect on the aerodynamic characteristics. The rotor produced large positive pitching moments at low and intermediate angles of attack which could not be trimmed with the range of cyclic pitch controls available. Moderate rolling moments were produced by the rotor which could be trimmed with the longitudinal cyclic pitch control. The maximum lift-drag ratio was about 0.75 for the short blade configurations and nearly 1.0 for the long blade configuration. Author

N71-16535*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EXPERIMENTAL AERODYNAMIC PERFORMANCE CHARACTERISTICS OF A ROTOR ENTRY VEHICLE CONFIGURATION. 3: SUPERSONIC

Ronald C. Smith and Alan D. Levin Washington Feb. 1971 56 p refs
(NASA-TN-D-7048; A-3711) Avail: NTIS CSCL 01C

Wind tunnel tests were conducted to determine the aerodynamic performance characteristics of an unpowered rotor entry vehicle configuration at Mach numbers from 1.62 to 3.54. Two rotor blade configurations with double-wedge and modified-ellipse profiles were tested at vehicle angles of attack from 15 to 90 deg. Variable blade collective pitch was used to control rotor rotational speed. Results of the tests indicate that the rotor speed is well

behaved and manually controllable through blade pitch. The maximum L/D varied from 0.75 at Mach number 1.62 to 0.66 at Mach number 3.54. The rotor produced destabilizing pitching moments rendering the basic configuration unstable and out of trim in glide flight. Cyclic feathering was found to be inadequate for longitudinal trim but was satisfactory for roll trim. The addition of body-mounted pitch flaps provided the necessary trim and eliminated the instability over most of the speed range. Author

N71-16538*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUBSONIC AERODYNAMIC CHARACTERISTICS OF A MODEL OF HL-10 FLIGHT RESEARCH VEHICLE WITH BASIC AND MODIFIED TIP FINS
Linwood W. McKinney and Jarrett K. Huffman Washington Jan. 1971 561 p refs
(NASA-TM-X-2119; L-7430) Avail: NTIS HC $10.00/MF $0.65 CSCL 01C

A wind-tunnel investigation was made at Mach numbers from 0.35 to 0.80 to determine the cause for the loss in lateral control experienced on the basic HL-10 during the first flight. The results of the study indicate that the loss in lateral control was associated with flow separation originating near the leading edge of the outboard fins and spreading over the inner fin surface and elevon controls with increasing angle of attack. Two modifications to the fin leading edge were tested and both modifications were effective in significantly reducing the amount of flow separation and, as a result, the lateral control characteristics were improved. Author

N71-16539*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPLORATORY INVESTIGATION OF THE STRUCTURE OF THE TIP VORTEX OF A SEMISPAN WING FOR SEVERAL WING-TIP MODIFICATIONS
James Scheiman and James P. Shivers Washington Feb. 1971 46 p refs
(NASA-TN-D-6101; L-7309) Avail: NTIS CSCL 01A

Wind-tunnel tests were performed on a semispan wing with rather radical wing-tip modifications. These modifications were chosen in an attempt to deform, displace, or modify the cross-sectional characteristics of the trailing tip vortex. The wing-tip modifications tested did not grossly affect the spanwise lift distribution and did not produce a noticeable change in the position of the downstream tip vortex. Tip-vortex cross-sectional variations were obtained such that the outer flow field was no longer potential flow. Author

N71-16568# Naval Postgraduate School, Monterey, Calif. Dept. of Aeronautics.
AERODYNAMIC DESIGN OF SYMMETRICAL BLADING FOR THREE-STAGE AXIAL FLOW COMPRESSOR TEST RIG
Michael H. Vavra 1 Sep. 1970 62 p refs
(AD-714585; NSP-57VA70091A) Avail: NTIS CSCL 14/2

The report deals with the aerodynamic design of an axial compressor stage with symmetrical bladings for a research program to investigate tip clearance effects in a three-stage compressor. It establishes the blading data and the stage performance with an iterative three-dimensional approach, and gives criteria for the drive and the flow measuring device of the test unit. The calculated distributions of the flow properties in the stage will be used for future comparisons with test data. Author (GRA)

N71-16628# Sandia Corp., Albuquerque, N. Mex.
PIONEER RTG HEAT SOURCE DROP TESTS
J. L. Entrekin Aug. 1970 126 p Sponsored by AEC
(SC-DR-70-560) Avail: NTIS

Eighteen simulated pioneer heat sources representing four different heat source shapes were drop-tested at Tonopah Test Range to obtain terminal velocity data and reduced trajectory data. A secondary objective was the acquisition of data related to impact crater and soil characteristics. Photographs of the samples before impact and reduced trajectory data are presented. Author (NSA)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N71-16720# Royal Aircraft Establishment, Farnborough (England). Avionics Dept.
THE USE OF CROSS-CORRELATION AND POWER SPECTRAL TECHNIQUES FOR THE IDENTIFICATION OF THE HUNTER Mk.12 DYNAMIC RESPONSE
D. E. Fry London Aeron. Res. Council 1970 43 p refs Supersedes RAE-TR-69156; ARC-31760
(ARC-CP-1121; RAE-TR-69156; ARC-31760) Copyright. Avail: NTIS; HMSO: 11s [55p]; BIS: $2.20

A method of identifying the short-period longitudinal transfer function and impulse response of the Hunter Mk.12 from flight data, using cross-correlation and power spectral techniques, is described. The input was a pilot-induced pseudo-random binary sequence on the elevator via the control column, and the output was the pitch rate response of the aircraft as measured by a rate gyro. Digital computer programs were used to calculate the relevant auto and cross-correlation functions, and the power spectra. The results, Bode plots and time responses agreed with theory. Author (ESRO)

N71-16721# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
VERTICAL ACCELERATION IN THE COCKPIT OF A SUBSONIC TRANSPORT AIRCRAFT DURING TAKE-OFF MEASURED DURING AIRLINE OPERATION
C. G. B. Mitchell London Aeron. Res. Council 1970 38 p refs Supersedes RAE-TR-69215; ARC-32122; CAADRP-TR-18
(ARC-CP-1120; RAE-TR-69215; ARC-32122; CAADRP-TR-18) Copyright. Avail: NTIS; HMSO 45p; BIS: $1.80

The vertical acceleration in a Boeing 707-436 cockpit was measured during 94 take-offs and that near the center of gravity (c.g.) during 33 take-offs from 31 airports. At a given airport the cockpit acceleration at a weight of 140,000 kg was about twice that at 90,000 kg but the c.g. acceleration did not vary with weight. The cockpit acceleration amplitude varied between airports by a factor of about two at 115,000 kg. The cockpit/c.g. acceleration ratio was between 0.9 and 2.3, but for more than 80% of take-offs was between 1.0 and 1.5. The vibration levels experienced had no detectable effect on errors of rotation speed at take off. Author (ESRO)

N71-16722# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
OPERATIONAL AND THEORETICAL STUDIES ON THE EFFECT OF PILOT ACTION ON HEAVY LANDINGS

H. Hall and G. B. Hutton London Aeron. Res. Council 1970 38 p refs Supersedes RAE-TR-69278; ARC-321146
(ARC-CP-1119; RAE-TR-69278; ARC-32146) Copyright, Avail: NTIS; HMSO: 50p; BIS: $2.00

Pilot action can modify the consequences of heavy landings involving bounce, both beneficially and detrimentally. Large elevator movements, leading to fluctuations in lift, can increase bounce height and structural loadings. Author (ESRO)

N71-15820*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

ENGINE EXHAUST NOISE DURING GROUND OPERATION OF THE XB-70 AIRPLANE

Paul L. Lasagna and Terrill W. Putnam Washington Jan. 1971 36 p refs
(NASA-TN-D-7043; H-599) Avail: NTIS CSCL 01A

Engine noise of XB-70 aircraft was measured from 90 deg to 160 deg from the airplane heading at a radius of 500 feet (152 meters). Overall sound pressure levels, perceived noise levels, and normalized spectra are presented for jet exhaust velocities up to 3300 feet/second (1006 meters/second), various engine spacings, and various numbers of adjacent engines operating. The direction of propagation of maximum noise levels moved from 135 deg to 120 deg as either the jet velocity was increased or the number of adjacent engines operating was increased. As the distance between two operating engines became greater, the overall sound pressure level increased as the angle between the microphone position and the exhaust axis decreased. The overall sound pressure level agreed best with the SAE prediction levels at an angle of 120 deg for exhaust velocities between 1500 feet/second (457 meters/second) and 3000 feet/second (914 meters/second). The SAE method adequately estimated the noise spectrum of the XB-70 airplane for subsonic exhaust flow and underestimated the high-frequency spectral levels for supersonic flow. Some shielding of the high frequencies was observed when two or more adjacent engines were operating in supersonic exhaust flow conditions. The noise spectrum shape was independent of jet exhaust velocity for the XB-70 engines with supersonic flow. Author

N71-15964*# Boeing Co., Seattle, Wash.

STUDY AND DEVELOPMENT OF TURBOFAN NACELLE MODIFICATIONS TO MINIMIZE FAN-COMPRESSOR NOISE RADIATION. VOLUME 3: CONCEPT STUDIES AND GROUND TESTS Contractor Report, 1 May 1967 1 Nov. 1969

Washington NASA Jan. 1971 84 p ref
(Contract NAS1-7129)
(NASA-CR-1713) Avail: NTIS CSCL 21E

The program objective was the reduction by 15 PNdB of Boeing 707-320B/C airplane noise during landing approach. It was determined that this goal could be achieved by attenuating the fan noise of the P & W JT3D engines by acoustically treating the engine nacelle. The nacelle fan exhaust duct design was required to contribute the full 15-PNdB attenuation, while the inlet need only attenuate 10 PNdB, since forward noise radiation was five PNdB lower. Various configurations of the inlet and fan duct, with acoustic treatment, were studied. The inlet design selected has two concentric rings supported from the cowl by struts at eight radial locations. Polyimide fiberglass acoustic sandwich material is used integrally with the structure of the concentric rings, inner cowl wall, and centerbody. A full length fan exhaust duct with annular nozzle essentially coplanar with the primary nozzle was selected. Acoustic treatment was applied to approximately one-third of the duct length in which inner and outer duct walls as well as four radial flow channel splitters are of polyimide fiberglass acoustic/structural sandwich materials. Ground test results, compared with baseline ground test data on the 707 airplane production nacelle, showed approximately two percent increase in thrust due to the new duct design. This gain is offset by increased recovery loss of the new inlet. A takeoff thrust noise reduction of five to six PNdB was predicted from the test results. Author

N71-16019# Human Engineering Labs., Aberdeen Proving Ground, Md.

SUITABILITY FLIGHT TEST OF THE KAISER FP-50A DISPLAY UNIT IN THE H-1G (COBRA) HELICOPTER

Harry R. Stowell and Murray Foster, Jr. Sep. 1970 30 p refs
(AD-714670; HEL-TN-9-70) Avail: NTIS CSCL 19/5

The Kaiser FP-50A display unit is modified to provide tactical information to the pilot. Inputs are received from the gunners sight to present steering information for the pilot to maneuver the aircraft into position to fire rockets at a target being tracked by the gunner. The report presents work performed to support the SEA NITEOPS Program. Human factors engineering guidance is provided to the program by the Human Engineering Laboratories. This phase of the program involved making a human factors evaluation of the Kaiser FP-50A flight display integrated with the AH-1G (COBRA) weapon system (XM-28). Author (GRA)

N71-16059# National Transportation Safety Board, Washington, D.C.

[AIRCRAFT ACCIDENT PRELIMINARY REPORT:] CAPITOL INTERNATIONAL AIRWAYS, INCORPORATED, MCDONNEL DOUGLAS DC-8-63F N4909C, ANCHORAGE, ALASKA, 27 NOVEMBER 1970 News Release.

28 Jan. 1971 10 p
(SB-71-5) Avail: Issuing Activity

A preliminary report of the known facts in the accident of the Capitol International Airways Flight C2C3/26 is presented. The airplane crashed and burned at a point 3400 feet from the end of Runway 6R at Anchorage, Alaska. The investigations to determine the cause of the accident are continuing to obtain data relative to the ability of the aircraft wheels to rotate properly under conditions of low tire-to-runway surface friction coefficients, and tests of the airplane's brake assemblies are being conducted to determine the overall condition and performance capability of these units. F.O.S.

N71-16070# National Transportation Safety Board, Washington, D.C.

AIRCRAFT ACCIDENT PRELIMINARY REPORT: MISSISSIPPI VALLEY AIRWAYS, INCORPORATED, DE HAVILLAND DHC-6 N956SM, LACROSSE, WISCONSIN, 9 NOVEMBER 1970 News Release

29 Jan. 1971 9 p
(SB-71-6) Avail: Issuing Activity

A preliminary report of the known facts of the aircraft accident of the Mississippi Valley Airways, Inc., Flight 106 at LaCrosse, Wisconsin, on November 9, 1970 is presented. The crash of the DHC-6 occurred while executing a VOR approach in instrument flight conditions. F.O.S.

N71-16087* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

FLIGHT CRAFT Patent

Alfred J. Eggers, Jr., Clarence A. Syvertson, George G. Edwards, and George C. Kenyon, inventors (to NASA) Issued 4 Oct. 1966 (Filed 4 Feb. 1964) 11 p Cl. 244-1
(NASA-Case-XAC-02058; US-Patent-3,276,722; US-Patent-Appl-SN-342572) Avail: US Patent Office CSCL 01C

A flight craft is described which is suitable for space flight, reentry into an atmosphere, and atmospheric flight. The craft has a high ratio of volume-to-surface area and a low-drag aerodynamic

shape so that the deceleration force during reentry is within confortable limits. The vehicle is maneuverable by its own movable control surfaces and has a wide glide range for optimum selection of landing sites. R.B.

N71-16261# California Inst. of Tech., Pasadena.
A THEORY OF TWO-DIMENSIONAL AIRFOILS WITH STRONG INLET FLOW ON THE UPPER SURFACE Final Report, 1 Nov. 1967 - 31 Dec. 1969
Sedat Serdengecti and Frank E. Marble Aug. 1970 59 p refs
(Contract F33615-68-C-1013)
(AD-714076; ARL-70-0139) Avail: NTIS CSCL 1/3

The two-dimensional theory of airfoils with arbitrarily strong inlet flow into the upper surface was examined with the aim of developing a thin-airfoil theory which is valid for this condition. Such a theory has, in fact, been developed and reduces uniformly to the conventional thin-wing theory when the inlet flow vanishes. The integrals associated with the arbitrary shape, corresponding to the famiar Munk integrals, are somewhat more complex but not so as to make calculations difficult. To examine the limit for very high ratios of inlet to free-stream velocity, the theory of the Joukowski airfoil was extended to incorporate an arbitrary inlet on the surface. Because this calculation is exact, phenomena observed in the limit cannot be attributed to the linearized calculation. These results showed that airfoil theory, in the conventional sense, breaks down at very large ratios of inlet to free-stream velocity. This occurs where the strong induced field of the inlet dominates the free-stream flow so overwhelmingly that the flow no longer leaves the trailing edge but flows toward it. Then the trailing edge becomes, in fact a leading edge and the Kutta condition is physically inapplicable. For the example in this work, this breakdown occurred at a ratio of inlet to free-stream velocity of about 10. This phenomenon suggests that for ratios in excess of the critical value, the flow separates from the trailing edge and the circulation is dominated by conditions at the edges of the inlet. Author (GRA)

N71-16262# Army Aviation Systems Test Activity, Edwards AFB, Calif.
ROTARY WING VEHICLE EXTERNAL STORES JETTISON ENVELOPE PILOT ESTABLISHED REQUIREMENTS Final Report, Mar. 1968 - Feb. 1970
Wayne B. Davis and Alan L. Hoffman Aug. 1970 44 p refs
(AD-713872; USAASTA-68-22) Avail: NTIS CSCL 1/3

The numbers and types of Army helicopters having external stores configurations have increased significantly in recent years. Extensive testing has been required to establish or demonstrate the jettison envelope. In some cases, this envelope has not always been compatible with the mission requirements since there is no firm guidance concerning the aircraft/stores interface or requirements for the stores jettison capability or characteristics. The jettison envelope study program was designed to examine the envelope requirements from a pilots viewpoint and develop a technical basis for establishing design, demonstration and testing requirements. Either aerodynamic or forced separation may be used to satisfy the requirements. It was determined that the aircrafts stability and control characteristics can be used to define the minimum jettison envelope that can be perceived by the pilot. Of these characteristics, lateral side-force is the most reliable cue available to the pilot. This is a function of the static directional stability and effective dihedral. A lateral sideforce corresponding to an acceleration of 0.1g was recognized by all pilots participating in the program. A method is shown whereby this information can be used to develop a recognizable envelope from which the pilot should be able to safely jettison stores. This method can be used as a technical basis to provide design guidance, establish demonstration requirements and develop more effective testing procedures. Author (GRA)

N71-16557*# City Univ. of New York. Dept. of Civil Engineering.
TRANSMISSION OF SONIC BOOM PRESSURE THROUGH A WINDOW PANE
Jacques E. Benveniste and David H. Cheng Nov. 1970 19 p refs
(Grant NGR-22-013-039)
(NASA-CR-111846; Rept-9) Avail: NTIS CSCL 01C

In previous studies of the effects of sonic booms on structures, the structural elements were assumed to be subjected to the outside overpressure. Actually, a certain amount of energy is transmitted to the interior of the structure and exterior structural elements are subjected to a net pressure equal to the difference between exterior and interior overpressure. The computation of the actual net pressure would be a hopeless task since the interior overpressures depend on the multiple reflections and the absorption of sound waves by walls, floors and ceilings. As an approximation of the situation near a window, the case of an elastic plate set in a rigid, infinite baffle and subjected to a N-shaped sonic boom normal to its plane was studied. The plate was assumed square and simply supported along its edges. Author

N71-16558*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROBLEM AREAS FOR LIFT FAN PROPULSION FOR CIVIL VTOL TRANSPORTS
S. Lieblein 1970 35 p refs Presented at DGLR Symp. on VTOL Propulsion, Munich, 22 - 23 Oct. 1970
(NASA-TM-X-52907; E-5614-2) Avail: NTIS CSCL 01C

The feasibility of VTOL intercity air transportation systems has been explored by a number of American and European organizations and government agencies. It is recognized that there are many aspects to the problem of a VTOL transportation system - economic, sociological, and political, as well as technological. Examples of recent thinking on these aspects are presented. A total systems approach is undoubtedly required for the successful development of commercial VTOL. Author

N71-16584*# Boeing Co., Seattle, Wash.
STUDY AND DEVELOPMENT OF TURBOFAN NACELLE MODIFICATIONS TO MINIMIZE FAN-COMPRESSOR NOISE RADIATION. VOLUME 8: ECONOMIC STUDIES Contractor Report, 1 May 1967 - 1 Nov. 1969
Washington NASA Jan. 1971 54 p refs
(Contract NAS1-7129)
(NASA-CR-1716) Avail: NTIS CSCL 01C

The economic implications of installing treated nacelles on Boeing 707-320B airplanes powered by P & WA JT3D-3B engines are studied. Operating costs are estimated for the year 1972. It was found that international direct operating costs (DOC) increase by 9.2 percent and domestic DOC increase by 9.6 percent. The major factor in these increases is the increase of depreciation cost. The additional depreciation cost is based on a predicted total installed retrofit price for 1972 of $1 million per airplane. The increase of indirect operating costs due to the retrofit is considered to be negligible. A hypothetical fleet study shows that a small loss of revenue earning capacity is involved, particularly over long range stages. For the route network considered in the study, a 0.1 percent loss of passenger revenue, a 4.3 percent increase of total operating costs and a 4.3 percent reduction in return based on passenger revenue is estimated. Author

N71-16584*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FLIGHT INVESTIGATION OF VTOL CONTROL AND DISPLAY CONCEPT FOR PERFORMING DECELERATING APPROACHES TO AN INSTRUMENT HOVER
John F. Garren, Jr., James R. Kelly, Robert W. Sommer, and Daniel J. Di Carlo Washington Feb. 1971 39 p refs
(NASA-TN-D-6108; L-7355) Avail: NTIS CSCL 01C

Described is a VTOL-oriented display and control concept

which provides a capability of studying operational aspects of the decelerating approach problem. Flight tests were conducted with a research helicopter equipped with a control augmentation system and a flight-director display, along with more conventional situation displays. The tests documented the maximum deceleration rates that could be achieved, effects of winds, and approach and hover performance. Author

N71-16627*# McDonnell-Douglas Co., Long Beach, Calif.
INVESTIGATION OF DC-8 NACELLE MODIFICATIONS TO REDUCE FAN-COMPRESSOR NOISE IN AIRPORT COMMUNITIES. PART 4: FLIGHT ACOUSTICAL AND PERFORMANCE EVALUATIONS, FOR PERIOD MAY 1967 - OCTOBER 1969
E. L. Zwieback, E. M. Lowder, E. A. Ilkcagla, H. Andresen, C. A. Henry et al Washington NASA Dec. 1970 151 p refs
(Contract NAS1-7130)
(NASA-CR-1708) Avail: NTIS CSCL 01A

Acoustically-treated engine nacelles for Douglas DC-8-50/61 airplanes were flight tested using a DC-8-55 airplane. The flight noise and performance measurements were supplemented by measurements made on an engine test stand. Significant noise reductions were obtained with the nacelle modifications. Beneath the landing approach path, at a height of 370 ft and with a landing weight of 240,000 lb, the effective perceived noise level would be reduced by 10.5 EPNdB. Beneath the initial-climb flight path, a 325,000-lb airplane climbing with rated-takeoff thrust would produce 3.5 EPNdB less noise at a point 3.5 n. mi. from start of takeoff roll and 3 EPNdB less maximum noise along a 1500-ft sideline. Installed net thrust at rated-takeoff power was reduced 2.1 percent with the nacelle modifications. Cruise performance was improved with an average 3-percent increase in specific range. No adverse engine operational characteristics were encountered. Author

N71-16713*# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
A FEASIBILITY STUDY FOR AN ADVANCED AVIONICS FLIGHT TEST AIRCRAFT Final Report
Robert C. Kidder Nov. 1970 74 p refs
(Contract NAS9-10987)
(NASA-CR-114832; CAL-VI-2973-F-1; MCS-02526) Avail: NTIS CSCL 01C

An engineering study was performed from which recommendations were generated for modification of an existing aircraft to a configuration that will be suitable for flight demonstration of the integrated electronics system intended to be used for the guidance and control of the reusable space shuttle vehicle. From a wide variety of aircraft initially examined, the candidate aircraft were reduced to three: the Convair 580, Lockheed P3D, and the Lockheed C-130. Cost estimates were prepared for the conversion of these three candidate aircraft to the configuration of the space shuttle vehicle electronics test aircraft. After review of the conversion costs, the C-130E aircraft was selected as the one most suitable to the mission requirements. A detailed specification was written which sets forth the requirements for conversion of the selected aircraft to the desired electronic test bed configuration. A copy of this specification is included. Author

N71-16818# National Aviation Facilities Experimental Center, Atlantic City, N.J.
AIR TRANSPORT CABIN MOCKUP FIRE EXPERIMENTS Final Report, 1966 - 1970
John F. Marcy Dec. 1970 43 p refs
(FAA-RD-70-81; FAA-NA-70-39) Avail: NTIS

A study was made of the burning characteristics of airplane interior materials ignited inside a 640-cubic-foot cabin mockup enclosure. Test conditions were varied to investigate the effects of a number of factors on the ignition and propagation of flames within enclosures; namely: (1) flammability ratings of the materials as obtained from standard laboratory tests; (2) intensity, duration and type of the ignition source whether flaming or incandescent; (3) ventilation rate as provided by different size openings into the cabin enclosure; (4) partitioning of the cabin space by use of a fire barrier curtain; and (5) discharge of bromotrifluoromethane into the cabin atmosphere, both at different rates and total quantities of application before and during a fire occurrence. Comparative tests conducted on flame-retardant urethane and neoprene foams showed that the flash-fire hazard prevalent with the use of regular foam could be greatly reduced by replacement with these two self-extinguishing foams. A high-rate discharge system employing CF3Br(1301) was shown to be effective in rapidly extinguishing the flames of a foam fire. Author

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N71-15723# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Abt. Magnetofluiddynamische Energiewandlung.
THE FUEL CELL CONCEPT. A REVIEW OF BASIC PRINCIPLES
Richard James Henry Jul. 1970 25 p refs
(DLR-MITT-70-09) Avail: NTIS; ZLDI Munich: 7,60 DM

The discussion of single cell electrochemistry includes performance characteristics of the Apollo fuel cell using hydrogen-oxygen reactants. Modern applications of cells using air oxidant and hydrocarbon fuels are described and the relatively pollutant-free fuel cell exhaust is compared with that from commercial powerplants. Author (ESRO)

N71-15746*# Naval Ammunition Depot, Crane, Ind. Quality Evaluation Lab.
EVALUATION PROGRAM FOR SECONDARY SPACECRAFT CELLS. ACCEPTANCE TEST OF GULTON INDUSTRIES 5.0 AMPERE-HOUR NICKEL-CADMIUM SPACECRAFT CELLS WITH COBALT ADDITIVE
D. E. Christy 22 Oct. 1970 25 p
(NASA-Order W-12397)
(NASA-CR-115788; QE/C-70-692) Avail: NTIS CSCL 10B

Fifty cells rated at 5.0 ampere hours were tested for use as spacecraft cells. The tests were designed to insure that all cells put into the life cycle program were of high quality by removal of cells found to have electrolyte leakage, internal shorts, low capacity, or inability to recover open circuit voltage above 1.15 after cell short tests. Results show no cell exceeded a charge voltage of 1.45 during the 48 hour charge. E.H.W.

N71-15840*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL INVESTIGATION OF CONDENSER PRESSURE CONTROL DURING SNAP-8 STARTUP. 2: DEADBAND FLOW CONTROL OF CONDENSING PRESSURE
Roland C. Fisher and Roy C. Tew Washington Jan. 1971 40 p refs
(NASA-TM-X-2115; E-5730) Avail: NTIS CSCL 18N

A critical area of concern in the startup of the SNAP-8 system to the self-sustaining level is the controllability of the condenser inlet static pressure. A deadband condenser inlet pressure

control method was applied to a SNAP-8 system in a ground test facility. This control method, wherein condenser inlet pressure excursions outside the deadband limits resulted in ramp changes in flow of the condenser coolant, was used successfully during a large number of start tests of the system. Parameters that could be manipulated in optimizing this control method were investigated. The influence of outside disturbances on operation of the control was also noted. Author

N71-15883# Naval Ammunition Depot, Crane, Ind. Quality Evaluation Dept.
ANALYSIS AND EVALUATION OF SPACECRAFT BATTERY ACCELERATED LIFE TEST DATA
22 Sep. 1970 81 p
(AD-713457; QE/C-70-687) Avail: NTIS CSCL 10/3

The report presents the findings from the mathematical/statistical analysis of data generated from the accelerated life test on 40 nickel-cadmium spacecraft battery cells. Two major objectives of the analysis were to: (1) determine the applicability and reliability of the previously developed cell life prediction model when applied to an accelerated life situation and (2) attempt to make alterations in the prediction model which would make it more conducive to accelerated life testing. Results of the analysis, based on eight failures to date, indicate: (1) about 75% accuracy in predicting the useful life of a cell with the original prediction model and (2) the application of Bayesian analysis techniques yields the same accuracy, but enables the model to be formally used in the absence of historical data. Author (GRA)

N71-15941# Minnesota Univ., Minneapolis. Cosmic Ray Group.
ELECTROLYTIC CELL TIMERS FOR BALLOON-BORNE APPLICATIONS
Gerald Anderson Dec. 1970 12 p ref
(Contract N00014-67-A-0113-0004; Grant NSF GA-13984)
(CR-154) Avail: Issuing Activity

The design of an electronic timer circuit using electrolytic cells as the timing elements for balloon-borne applications and times from 2 hours to several days is presented. Author

N71-16032# Mallory (P. R.) and Co., Inc., Burlington, Mass. Lab. for Physical Science.
LONG SHELF LIFE ORGANIC ELECTROLYTE BATTERY Quarterly Report, 20 Jun. - 17 Sep. 1970
A. N. Dey and L. F. Athearn Nov. 1970 384 p
(Contract DAAB07-70-C-0076)
(AD-714675; ECOM-0076-3; QR-3) Avail: NTIS CSCL 10/3

The fabrication of prototype organic electrolyte cells having wide operating temperature range and high energy density is proceeding. Testing of these cells has yielded energy densities of 40 watt hours per pound at -30C. This energy density is attained during a 400 hour discharge. Tests on developmental cells at room temperature have given energy densities over 70 watt hours per pound during discharge extending over 1600 hours. Tests on developmental cells at 0C have run over 800 hours and are continuing. Author (GRA)

N71-16115# California Univ., Los Angeles. School of Engineering and Applied Science.
NONAQUEOUS ELECTROLYTE SYSTEM: IONIC TRANSPORT IN NONAQUEOUS MEDIA Interim Report No. 7
Limin Hsueh, Alphonzo G. Nelson, Zia I. Mirza, and Douglas N. Bennion Fort Belvoir, Va. Mobility Equipment Res. and Develop. Center Jul. 1970 56 p refs
(Contract DA-44-009-AMC-1661(T))
(AD-714680; UCLA-ENG-7084) Avail: NTIS CSCL 10/3

The purpose of the work reported was to determine the general suitability of beta-alumina for use in electrochemical systems and the suitability of lithium perchlorate-dimethyl sulfite and lithium tetrafluoroborate-dimethyl sulfite electrolyte solutions in electrochemical fuel cells or batteries. The emphasis is on the nature of ionic conduction in beta-alumina and the nature of ionic transport in the dimethyl sulfite electrolytes. Author (GRA)

N71-16348# Eagle-Picher Co., Joplin, Mo. Couples Dept.
SEALED NICKEL-CADMIUM BATTERY ASSEMBLY BB-655 ( )/U Final Report, 1 Jun. 1969 - 30 Sep. 1970
Dale Gordon Sep. 1970 64 p
(Contract DAAB07-69-C-0408)
(AD-714243; ECOM-0408-F) Avail: NTIS CSCL 10/3

The purpose of the contract was the design, development and testing of the nickel-cadmium battery assembly BB-655()/U. This battery assembly is a military-ruggedized design consisting of 20 series-connected F cells assembled between two (2) fiberglass circuit boards and restrained with a rigid epoxy potting. The battery assembly is rated at 24 volts and 7.0 ampere-hours or 12 volts and 14 ampere-hours. This multiple voltage arrangement is possible as a result of the USAECOM connector arrangement. Fifty-nine (59) battery assemblies were constructed and 16 were successfully tested to environmental and electrical testing. The environmental tests included vibration, bounce and four foot (4) drop testing of all corners, faces and edges with cover and simulated equipment. This Final Report outlines the design and development program and fully documents the battery assembly design. Complete drawings to USAECOM format are included in the Final Report as well as Artists Visualization of the battery assembly. Author (GRA)

N71-16430*# Globe-Union, Inc., El Monte, Calif.
RESEARCH, DEVELOPMENT, AND FABRICATION OF LITHIUM SOLAR CELLS, PART 1: Final Report
Peter A. Iles 23 Nov. 1970 46 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952546)
(NASA-CR-116180) Avail: NTIS CSCL 10B

A program is described for developing lithium-doped silicon solar cells which give superior performance in space. The optimum combination of the materials and fabrication methods used is emphasized. Improved boron diffusion methods provide improved I-V characteristics for oxygen-lean silicon cells, and near equivalent values for the two types of silicon can be obtained using the same fabrication conditions. The concentration of lithium throughout the cells was measured by a movable resistance probe and by analysis of the variation of reverse-bias capacitance as the bias was increased. R.B.

N71-16472*# Radio Corp. of America, Princeton, N.J. Astro-Electronics Div.
STUDY TO DETERMINE AND IMPROVE DESIGN FOR LITHIUM-DOPED SOLAR CELLS Quarterly Report, 1 Oct. - 31 Dec. 1970
T. Faith, G. Brucker, and A. Holmes-Siedle 10 Jan. 1971 23 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952555)
(NASA-CR-116220; AED-R-3892F; QR-6) Avail: NTIS CSCL 10B

The action of lithium in producing a recovery or spontaneous annealing of radiation damage in bulk silicon and silicon solar cells is discussed. Analytical techniques to characterize the radiation resistance of lithium-doped solar cells and its dependence on the materials and processes used to fabricate the solar cells are presented. Recommendations for an improved design of lithium-doped solar cells are included. Author

N71-16559# Kentucky Univ., Lexington.
THE EFFECTS OF STRUCTURAL MOTION OF THE

DYNAMIC RESPONSE OF LIQUID FLOW SYSTEMS AND AUTOMATIC CONTROL HYDRAULIC SYSTEMS
Don J. Wood Oct. 1970 12 p
(Grant DA-ARO-(D)-31-124-856)
(AD-714283; AROD-6999.9-E) Avail: NTIS CSCL 13/7

Comprehensive studies on the effect of structural motion on the response and control of liquid flow systems were completed. Detailed analytical and experimental studies established the importance of motion of transmission lines on fluid system responses. The study developed both plane wave and impedance analyses to predict the effects of motion, and the experimental results establish the validity of the analyses. It is concluded that the effects of line motion may be major, and in some cases, the prime consideration in the design and control of fluid systems, and that the methods developed should be employed to predict these effects. Author (GRA)

N71-16563*# Heliotek, Sylmar, Calif.
DEVELOPMENT OF LITHIUM DIFFUSED RADIATION RESISTANT SOLAR CELLS, PART 1 Final Report, 17 Jun. 1969 - 19 Jun. 1970
P. Payne and H. Somberg 15 Jul. 1970 54 p refs Prepared for JPL
(Contract NAS7-100; JPL-952547)
(NASA-CR-116219) Avail: NTIS CSCL 10B

TiAg, TiPdAg and Al contact systems on P/N cells were evaluated for strength and humidity resistance. Contact strength tests were performed by soldering or ultrasonically welding tabs to the contacts and pulling at a 90 deg angle until failure. Both tab attaching methods were used to evaluate the TiAg and TiPdAg contacts. The soldered bonds withstood more than 500 grams pull (when the silicon did not fail) and the ultrasonically welded bonds withstood more than 150 grams pull. In both cases the pull strengths are comparable to those obtained with TiAg contacts on standard N/P cells. Humidity testing of these three contact systems gave the following results: (1) TiAg front contacts peeled significantly (35% average) when tape tested after 100 hours of exposure to 95% relative humidity at 65 deg and peeled 100% after 200 hours exposure. (2) Al contacts withstood 288 hours exposure before peeling occurred; then two out of ten cells exhibited peeling (30% of the bar on one cell and 80% of the bar on another cell). (3) One out of ten of the TiPdAg contacted lithium cells had approximately 20% of the bar peel after 288 hours. Author

N71-16570*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
AN EXPERIMENTAL LIQUID METAL SLIP RING TO TRANSFER POWER BETWEEN ROTATING SATELLITE PARTS Final Report
S. M. Weinberger Aug. 1970 122 p refs
(Contract NAS3-11538)
(NASA-CR-72790; DOC-70SD4282) Avail: NTIS CSCL 10B

An engineering model liquid metal slip ring was developed to transfer electrical power across a rotating joint in a satellite. The slip ring was operated at 100 amps DC at voltages up to 3000 volts at rotational speeds of 1 revolution per day, in air and vacuum environments. The liquid metal was gallium; the electrode materials were tungsten, tantalum, and molybdenum; and the insulation was Delrin. A contamination of gallium was observed and efforts made to identify it. Author

N71-16708*# LTV Aerospace Corp., Dallas, Tex. Vought Aeronautics Div.
ADVANCED SPACECRAFT ELECTRICAL POWER SYSTEMS APPLYING SOLID STATE TECHNOLOGY Final Report, 1 Jan. - 31 Dec. 1970
D. H. Preston Dec. 1970 186 p refs
(Contract NAS9-10408)
(NASA-CR-114815; Rept-2-55900/OR-2870) Avail: NTIS CSCL 10B

Three electrical power distribution and control system concepts were established and investigated in detail. These were (1) the conventional system concept using electromechanical switches, relays, and circuit breakers; (2) the hybrid system concept using electromechanical devices for power switching and circuit protection, solid state signal sensing, and a dedicated data handling system incorporating programmable logic control and signal multiplexing; and (3) the solid state system concept using solid state devices for power switching and circuit protection, solid state signal sensing, and a dedicated programmable logic and multiplexing control system. The solid state system was selected on the basis of weight, size, reliability, performance, flexibility, EMI compatibility, and built-in-test. Recommendations were made for the development of multichannel power controllers, simplified signal sources incorporating built-in-test features, and the dedicated data handling system. Author

N71-16710# Rasor (Ned S.), Dayton, Ohio.
PRACTICAL ASPECTS OF FUNDAMENTAL RESEARCH IN THERMIONIC CONVERSION Summary Technical Report, 1 Mar. - 31 Aug. 1970
Ned S. Rasor 30 Oct. 1970 27 p refs
(Contract N00014-70-C-0252)
(AD-714253; NSR-1-2) Avail: NTIS CSCL 10/2

The first half year of activity on pathfinder tasks, to define and utilize basic thermionic converter research for practical purposes, is reported. The elementary theory presented in a preceding report is compared with experimental data covering a wide variety of conditions. A correlation of experimental variables is found which is consistent with the previous formulation and gives insight into the nature of the ion generation process. The data also suggest that an elementary but adequate description of the saturation region of the discharge is that it is dominated by a fully ionized space adjacent to the emitter, characterized by a relatively high but constant electron temperature compared with that in the bulk plasma. Experimental work has been initiated to use an argon discharge as an analog system in which to evaluate improvements in cesium vapor converter electrode configurations. Experimental techniques have been tested in a preliminary apparatus, including a new deformable emitter, mapping probe, etc. Author (GRA)

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N71-15718# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
EFFECTS ON HEALTH OF ATMOSPHERIC DISCHARGES OF TRITIATED STEAM
Jacques Planet, Guy Uzzan, and Jacques Le Grand 1970 23 p refs In FRENCH Presented at the 2d Congr. of the Intern. Radiation Protection Assoc., Brighton, England
(CEA-CONF-1560; CONF-700505-11) Avail: AEC Depository Libraries

A general method of evaluating the irradiation of man is first described and then applied to the case of a given site. The dispersion of tritiated water in the physical environment (dispersion in air, rainwater contamination, and ground contamination), the contamination of plant and animal foodstuffs, and finally the

irradiation of man are examined. The dose corresponding to a yearly exposure in a contaminated atmosphere and the variation in this dose as a function of the age of individuals are estimated. The dose absorbed by ingestion of tritiated water vapor is also studied. This method is applied to a plant, 3 km distant from a village, discharging tritiated steam continuously through a chimney. Author (NSA)

N71-15724# Johann-Wolfgang-Goethe-Universitat, Frankfurt am Main (West Germany).
INVESTIGATIONS ON LUMINOUS BACTERIA FOR EXPERIMENTS IN ROCKETS AND SATELLITES [UNTERSUCHUNGEN AN LEUCHTBAKTERIEN FUER RAKETEN- UND SATELLITENEXPERIMENTE]
H. Buecker, G. Horneck, E. Kuepper, and G. Roeder Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss. Aug. 1970 59 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-70-46) Avail: NTIS; ZLDI Munich: 12 DM

Continuous measurements of spaceflight effects on cellular metabolism were planned using bacterial luminescence. Tests were conducted with luminous bacteria (Photobacterium harveyi and pierantonii) and the effects of selected simulated space factors e.g. ultraviolet light, high vacuum, on luminescence, growth, and colony formation were investigated and found to be similar. The luminescence increased after ultraviolet irradiation of 600 microwatt sec/sq cm. Author (ESRO)

N71-15858 Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
THEORY OF NERVOUS REGULATION OF INTRAOCULAR PRESSURE
R. W. Hart *In its* APL Tech. Dig., Vol. 9, No. 4 Apr. 1970 p 2-13 refs (See N71-15857 08-23)
(Grant PHS-NS-07226)
Copyright. Avail: APL, Johns Hopkins Univ., 8621 Georgia Ave., Silver Spring, Md. 20910: $0.50

A phenomenological theory is developed that mimics a number of features characteristic of the living eye. The two essential concepts are: (1) both aqueous humor and venous blood compete for space in the aqueous outflow drainage channels so the aqueous outflow resistance depends on the rate of blood flow, and (2) blood flow, and thereby the rate of formation of aqueous humor, is controlled by vasoconstrictors and vasodilators excited by neural elements that respond to tissue deformation. The theory is applied to develop a detailed conception of how intraocular pressure is regulated in the normal eye and what may go wrong when pressure regulation deteriorates in the abnormal eye. Author

N71-15884# Princeton Univ., N.J. Elementary Particles Lab.
APPLICATIONS OF CERTAIN HIGH ENERGY PHYSICS TECHNIQUES TO SOME PROBLEMS IN BIOLOGY
George T. Reynolds 4 Jul. 1970 58 p refs
(Contract AT(30-1)-4159)
(PURC-4159-1) Avail: NTIS

The development of image intensifiers in high energy physics is briefly reviewed, and the applications of image intensifiers in biological research are discussed. Topics include bioluminescence, image intensification of a luminescent system as a cytochemical probe, radioactive tracer detection, quantum efficiency of the human eye, and X-ray image intensification. NSA

N71-15913# Los Alamos Scientific Lab., N.Mex.
PRODUCTION OF ALGAE CONTAINING 93 PERCENT C 13
Eric B. Fowler and Victor H. Kollman May 1970 4 p refs
(Contract W-7405-eng-36)
(LA-4496) Avail: NTIS

Carbon-13 was biologically incorporated into Chlorella pyrenoidosa to the 93% level with no observable induction period or gross changes in cell morphology or size. Author (NSA)

N71-15929# Louisville Univ., Ky. Dept. of Psychology.
ORGANIZATIONAL AND TRANSFORMATIONAL PROCESSES IN MEMORY Final Report
John A. Robinson 1 Oct. 1970 7 p refs
(Grant AF-AFOSR-1008-67)
(AD-714630; AFOSR-70-2557TR) Avail: NTIS CSCL 5/10

The research has dealt with the relationships of coding to the speed and accuracy of recall. Specifically, the research examines: Effects of solution-word categorizability; effects of code structure and presentation order; knowledge of prior recall; and organization in free-recall learning. Author (GRA)

N71-15940*# Public Health Service, Phoenix, Ariz. Applied Microbiology and Planetary Quarantine Section.
SERVICES PROVIDED IN SUPPORT OF THE PLANETARY QUARANTINE REQUIREMENTS OF THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, OCTOBER - DECEMBER 1970
Martin S. Favero Jan. 1971 30 p
(NASA Order W-13062)
(NASA-CR-116182; Rept-32) Avail: NTIS CSCL 06M

Studies of the naturally occurring bacterial spore population from Cape Kennedy soil are discussed. The extinction of the population when exposed to 125 degrees C was beyond 16 hr. Additional preliminary attempts to determine the 125 degrees C end point at 24 and 30 hr were unsuccessful. All broth tubes into which heated strips were placed (QR 31) were positive for growth within 5 days of incubation at 32 degrees C. An equal number of uninoculated control strips included in each run remained negative after 5 days of incubation. After 48 hr of heating, however, 30 strips and 30 uninoculated controls were all negative for growth after 1 week of incubation. An FN-MPN testing system (QR 26) was therefore designed accordingly. Sixty inoculated strips and 60 control strips were suspended in the oven and 10 of each were removed at 1.5-hr intervals out to 48 hr. As strips were removed and cooled, they were placed in tubes of TSA broth plus 0.1% soluble starch and 0.2% yeast extract (QR 26) and incubated for 1 week at 32 C. All control strips were negative and the number of positive tubes per replicate of 10 at each heating interval is presented. Author

N71-15942# Systemed Corp., Dayton, Ohio.
TOXIC HAZARDS RESEARCH UNIT Final Report, Jun. 1969 - May 1970
J. D. MacEwen and E. H. Vernot Aug. 1970 98 p refs
(Contract F33615-70-C-1046)
(AD-714694; W70005; AFML-TR-70-77) Avail: NTIS CSCL 6/20

Modification of animal exposure facilities are discussed including the installation of an automatic weighing system in each Thomas Dome. Acute toxicity experiments were conducted on beta cloth glass fiber dust, chlorine trifluoride (ClF3), oxygen difluoride (OF2), and hydrogen fluoride. Subacute toxicity studies were conducted on 1,1,2-Trichloro 1,2,2-trifluoroethane and methylisobutylketone. The interim results of chronic toxicity experiments on monomethylhydrazine (MMH) are also described. Author (GRA)

N71-16022*# Sandia Corp., Albuquerque, N.Mex. Planetary Quarantine Dept.
PLANETARY QUARANTINE PROGRAM Quarterly Progress Report, 30 Sep. 1970

Sep. 1970 79 p refs
(NASA Order W-12853)
(NASA-CR-111309; QPR-18) Avail: NTIS CSCL 06M

Activities included an appraisal of the overall thermoradiation program along with considerable experimentation in dry heat, radiation and thermoradiation inactivation of B. subtilis var. niger. Heat resistance and dose rate sensitivity experiments at 95 C revealed promising results at that temperature. At a dose rate of 12 krads/hour, the D value was two hours. A 10 log population reduction could then be accomplished at 95 C with a total dose of less than 250 krads in 20 hours. Good confirmation was also obtained in the dose rate sensitivity of radiation inactivation at room temperature. High rate gamma radiation inactivation at room temperature required twice the total dose that low rate radiation required. A preliminary analysis of the radiation burden for a Mars Lander derived a safe upper bound of about 6300 krads of radiation encountered post launch. Author

N71-16049# London Univ. (England). Dept. of Zoology.
ULTRASONIC BIOACOUSTICS Final Scientific Report, 1 May 1965 - 30 Jun. 1970
J. D. Pye 31 Jul. 1970 12 p refs
(Contract AF 61(052)-876)
(AD-714632; AFOSR-70-2570-TR) Avail: NTIS CSCL 6/3

The following four areas of research are summarized: (1) the improvement of existing techniques and the development of novel methods for studying air-borne ultrasound; (2) acoustic aspects of echolocation in bats, especially a quantitative taxonomic survey of emitted signal patterns and their changes with behaviour; (3) a study of the newly discovered ultrasonic social communication in rodents and (4) studies of ultrasonic signals emitted by other groups of animals, especially by tittigonid grasshoppers and certain nocturnal moths. Author (GRA)

N71-16092# School of Aerospace Medicine, Brooks AFB, Tex.
MEDICAL AND BIOLOGICAL RESEARCH IN THE USSR DURING 1968 AND EARLY 1969 UNDER THE SPACE RESEARCH AND CONQUEST PROGRAM
V. V. Parin et al 1970 18 p Transl. into ENGLISH of the book "Medico-Biologichkie Issledovaniya, Provedennye v SSSR v Techenie 1968 G. I. Nachola 1969 G. Po Programme Issledovaniya i Osnoveniya Kosmicheskogo Prostranstva" Moscow, 1969 18 p
(AD-714407; SAM-TT-R-1024-0770) Avail: NTIS CSCL 6/19

A Chronic Experiment was begun on 180 dogs (138 males and 42 bitches) in order to investigate and provide an experimental basis for permissible radiation dosage during long space flights. The experiment was designed for several years of gamma radiation. The report sets forth some of the results obtained from observations made of the animals during two years of the experiment. Also, results of medical examinations of the crew members of Soyuz 3, 4, and 5 are summarized. GRA

N71-16151*# Agricultural Research Service, Weslaco, Tex.
REFLECTANCE AND STRUCTURE OF CYCOCEL-TREATED COTTON LEAVES, GOSSYPIUM HIRSUTUM L
H. W. Gausman, R. Cardenas, W. A. Allen, V. I. Myers, and R. W. Leamer *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 2 1968 9 p refs (See N71-16147 06-13)
Avail: NTIS CSCL 02A

Cycocel induced changes in the internal structure of cotton leaves and their relation to reflectance, transmittance, and absorptance of near infrared light were investigated. Cycocel treated leaves had more intercellular spaces in the spongy parenchyma which caused increased reflectance and decreased transmittance, particularly over the 750 micron to 1350 micron range in which the influence of internal leaf structure is highly important. Understanding the relation of light reflectance to the internal structure of leaves will be helpful in interpreting data obtained from aircraft and satellites. A.L.

N71-16152*# Agricultural Research Service, Weslaco, Tex.
RELUCTANCE PRODUCED BY A PLANT LEAF
W. A. Allen, A. J. Richardson, and H. W. Gausman *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 2 1968 13 p refs (See N71-16147 06-13)
Avail: NTIS CSCL 02A

Proper interpretation of multispectral imagery acquired from the NASA aircraft depends upon reliable ground truth information. In the case of vegetation, ground truth information can be reduced, in part, to effective optical parameters determined from individual leaves. Correlations can be, and have been, made between multispectral imagery acquired from the NASA aircraft and effective optical parameters measured in the laboratory. Author

N71-16158*# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.
DEVELOPING SPECTROSIGNATURE INDICATORS OF ROOT DISEASE ON LARGE FOREST AREAS
John F. Wear *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 2 1968 11 p (See N71-16147 06-13)
Avail: NTIS CSCL 06C

Losses to forest diseases are more serious threats to the forest natural resource than either fire or insects. It is of continuing importance to develop remote sensing techniques that will collect data rapidly on pest problems from aircraft and orbiting platforms. Expanded research on the spectral emission and the spectral reflectance properties of specific forest types and on the physiological parameters of healthy and root-rot-infected trees are of great potential value in analyzing this serious forestry problem. Considerable progress has been made in the development of remote sensing techniques for efficient disease detection surveys that may eventually become an integral part of resource surveys from orbital altitudes. Author

N71-16159*# Agriculture Dept., Berkeley, Calif. Forest Service.
DETECTION OF FOREST INSECT OUTBREAKS BY REMOTE SENSING
R. C. Heller *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 2 1968 62 p refs (See N71-16147 06-13)
Avail: NTIS CSCL 06C

Studies are underway in the Black Hills of South Dakota to determine the ground instrumentation, aerial sensing equipment, and techniques required to detect vigor loss and previsual signs of tree mortality caused by bark beetles in coniferous timber stands. Ground data have been collected on spectral reflectance, Munsell color notations, emitted and absolute temperature, transpiration, and needle moisture tension of ponderosa pine trees and foliage. Aerial photography (color and infrared color) was taken over six ground instrumented test sites at seven periods to capture changes in foilage coloration. Optical-mechanical scanning imagery was obtained in three wavebands (2.0 to 2.6 microns, 4.5 to 5.5 microns, and 8.0 to 14.0 microns). To date, no aerial sensor has been successful in detecting stressed conifers before the foliage discolors. No differences in photointerpretation accuracies have been found between color and false-color films. Scanners with better optical qualities exhibiting improved spatial and thermal resolution are needed before thermal techniques can be used with any degree of confidence. Author

N71-16160*# California Univ., Berkeley. School of Forestry and Conservation.

THE IDENTIFICATION OF WESTERN FOREST SPECIES BY MEANS OF REMOTE SENSING
Donald T. Lauer *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 2 1968 18 p (See N71-16147 08-13)
Avail: NTIS CSCL 08C

Systematic analysis of several factors governing the interpretability of tree species on high altitude, small scale imagery obtained by remote sensing was conducted. This research has sought, in particular, to determine which image characteristics are most useful for identifying the major tree species and timber types that occur in the western United States. Data acquired from the NASA aircraft are discussed and illustrated in the form of certain advanced techniques such as: (1) acquisition of sequential imagery, (2) acquisition of spectrozonal imagery, and (3) false color image enhancement of multiband imagery. In addition, a comparison has been made to determine the ease with which tree species composition, timber-type boundaries, and cultural patterns can be interpreted on Gemini photography and on a 10- by 15-foot aerial photographic mosaic comprised of 3200 conventional aerial photographs suitably reduced in scale. Author

N71-16200# Colorado Univ., Denver. Medical Center.
THE INFLUENCE OF HYPOXIA ON THE PULMONARY MICROCIRCULATION Annual Progress Report, 1 Oct. 1969 – 30 Sep. 1970
Wiltz W. Wagner, Jr. 1 Oct. 1970 18 p refs
(Contract DADA-17-68-C-8071)
(AD-714871; APR-3) Avail: NTIS CSCL 6/5

A technique designed to permit direct microscopic observation via a transparent window implanted in the chest wall of dogs of the pulmonary capillaries in vivo has been developed. Cine- and photomicrographic techniques have been developed to permit high speed, high resolution study of the pulmonary microcirculation. These systems have been designed to provide information related to the following: The velocity of the erythrocytes as they cross the alveolar capillary net to determine contact time between oxygen and hemoglobin; the orientation of the erythrocytes in the capillaries to determine the intracapillary diffusion distance of molecular oxygen; the site of action of the hypoxic vasopressor response; the quantitation of the oxyhemoglobin gradient along the microcirculation to determine a) the boundaries of the oxygen uptake process, b) the shape of the uptake curve, and c) how the curve and boundaries are affected by stress, e.g. hypoxemia or exercise; and the effect of fatty acid embolism on the pulmonary microcirculation. Author (GRA)

N71-16284# Air Force Systems Command, Brooks AFB, Tex. School of Aerospace Medicine.
NOISE PROBLEMS IN AEROMEDICAL EVACUATION OPERATIONS
Donald G. Gasaway and Harrell C. Sutherland Sep. 1970 22 p refs
(AD-713882; SAM-TR-70-50; SAM-Review-2-70) Avail: NTIS CSCL 20/1

Problems arising from the presence of noise in air evacuation aircraft are described. These include effects of noise on understanding speech and the possibility of noise-induced hearing loss. Examples of noise spectrums found in current air evacuation aircraft are given and their implications discussed. The effectiveness of ear protective devices, plugs and muffs, is described and factors involved in successful earplug use are listed. Author (GRA)

N71-16298# School of Aerospace Medicine, Brooks AFB, Tex.
MEDICAL AND BIOLOGICAL RESEARCH [MEDIKO-BIOLOGICHESKIYE ISSLEDOVANIYA]
1970 13 p Transl. into ENGLISH from Proceedings of COSPAR, 12th Meeting (Moscow), 1968
(AD-714406; SAM-TT-R-1043-0770) Avail: NTIS CSCL 6/19

Summaries are given of studies involving the effects of weightlessness and confinement on man and other organisms. GRA

N71-16313# Army Foreign Science and Technology Center, Washington, D.C.
DIURNAL VARIATIONS IN THE FUNCTIONAL ADJUSTMENT OF THE VISUAL ANALYZER DURING DIFFERENT SEASONS [SUTOCHNYYE IZMENENIYA FUNKTSIONALNOY NASTROYKI ZRITELNOGO ANALIZATORA V RAZNYYE PERIODY GODA]
L. M. Kurilova et al 14 Apr. 1970 14 p refs Transl. into ENGLISH from Fiziol. Zh. SSSR (Moscow), v. 60, no. 3, 1969 p 301–308
(AD-714064; FSTC-HT-23-062-70) Avail: NTIS CSCL 6/16

A study was made of changes in the dark-adaptation curve of two subjects, ages 35 and 40, and its variation according to time of day and season. Two indices were used: intensity threshold (characterizing level of sensitization) and threshold area of light stimulus (reflecting level of mobilization). All observations were carried out under uniform conditions in a dark testing room; thresholds were determined with a model AM adatometer and with a device designed by one of the authors and described in a previous work. Differences between the two subjects were noted and attributed to individual variation. Curves for different times of the year were found; shifts of maxima in the curves were correlated with the changes in the time of sunrise and sunset in different seasons. The results indicate the presence of a circadian rhythm of light sensitivity, varying seasonally, which persists even when the subject is tested in a dark room without the influence of natural illumination. These findings will be of interest in labor physiology, since work efficiency depends to a degree upon the punctuality of adaptive reactions of the visual analyzer. Author (GRA)

N71-16350# Geoscience, Ltd., Solana Beach, Calif.
STUDY OF THE INFLUENCE OF ELECTROMAGNETIC FORCE FIELDS ON BIOLOGICAL SYSTEMS Final Report, Jan. 1968 – Jan. 1970
Heinz F. Poppendiek, Gunnar Mouritzen, James E. Cloakey, and Patricia A. Greene Jul. 1970 43 p refs
(Contract F41609-69-C-0016)
(AD-714071; AMD-TR-70-1) Avail: NTIS CSCL 6/16

The report describes studies of the effects of unidirectional electromagnetic force fields, applied at a frequency of 800 cps, for six hours on dunaliella and ciliates suspended in media with electrical resistivity similar to the organism under study. Electromagnetic force fields were studied for significant differences in survival rate, external configuration, mobility and subsequent growth rate. Electrical resistivity measurements for several biological fluids and tissues are reported. Author (GRA)

N71-16388*# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
THE MEASUREMENT OF RADIATION EXPOSURE OF ASTRONAUTS BY RADIOCHEMICAL TECHNIQUES Quarterly Research Report, 6 Apr. – 5 Jul. 1970
R. L. Brodzinski and W. A. Haller 15 Jul. 1970 27 p refs Sponsored in part by NASA
(Contract AT(45-1)-1830)
(NASA-CR-116223; BNWL-1183-5) Avail: NTIS CSCL 06P

The urine and feces specimens from the Apollo 13 mission were analyzed for their radionuclide content. A comparison of radionuclide concentrations to those of the Apollo 9 mission yields a dose of ~ 250 mR for the Apollo 13 astronauts. The K-40, Fe-59, and Cs-137 concentrations in three of the fecal specimens were high compared to previously observed levels, while all other

radionuclide concentrations in both feces and urine remained comparable. Radioisotope concentrations in feces from the Apollo 7 through 11 missions and urine from the Apollo 11 and 12 missions were normalized to the weight of the respective inert element in the specimen, and confirmed all prior conclusions. Daily excretion rates of Ca, K, and Fe for Apollo 7 through 11 astronauts are found to be higher than the intake rates by factors of 2.24, 1.54, and 2.2, respectively. The observed concentrations and total weights of glass fibers in Apollo 13 feces fall within the range of results for previous missions except one sample which had large quantities of extremely long fibers in it. A piece of outer thermal coating of the Apollo 7 spacecraft yielded no cosmic-ray-induced nuclides 77 days after splashdown. Author

N71-16367# Argonne Cancer Research Hospital, Chicago, Ill.
INCREASED TURNOVER OF MITOCHONDRIAL CONSTITUENTS IN CARDIAC HYPERTROPHY AND ACUTE HYPOXIA IN THE RAT
V. Aschenbrenner, R. Albin, R. Zak, K. G. Nair, and M. Rabinowitz Jun. 1970 15 p refs Presented at 3d Ann. Meeting of the Intern. Study Group for Res. in Cardiac Metab., Stowe, Vt.
(Contract AT(11-1)-69; Grants NIH HE-9172; NIH HE-4442)
(ACRH-1000-199; CONF-700626-1) Avail: NTIS

Chemical composition changes in mitochondria, the principle sites of myocardial ATP synthesis, was observed during cardiac hypertrophy and acute hypoxia. Experimental cardiac hypertrophy was produced by banding the ascending aorta in rats; a 20 to 40% increase in heart weight was achieved within 36 to 48 hours after aortic constriction. Changes in mitochondrial mass were estimated from the activity of mitochondrial respiratory enzymes in homogenate and mitochondria. After exposure of rats to a six hour period of 4 to 5% hypoxia, the specific activity of mitochondrial proteins was 15 to 20% less than controls. J.A.M.

N71-16399# Army Medical Research Lab., Fort Knox, Ky.
SERIAL ISOMETRIC FATIGUE FUNCTIONS WITH VARIABLE INTERTRIAL INTERVALS
Lee S. Caldwell 5 Aug. 1970 20 p refs
(AD-714190; USAMRL-886) Avail: NTIS CSCL 6/16

The objective of this study was to measure the effects of repeated maximal isometric exertions with various intertrial intervals on the shape of the fatigue function, and to examine the relationship between strength and relative decrement. The maximum voluntary strength of 60 subjects was measured during ten successive 25-sec trials separated by rest periods of 25, 50, or 100 sec. The intertrial intervals within a session were constant. Response strength was recorded at 3-sec intervals from the beginning of the contraction thus yielding eight scores per trial and 80 scores per session for each subject. The adjustment to the various work-rest schedules occurred early in the trial series. When the reduction in mean output was taken as 100% for each rest condition, the loss between the first two trials was 33%, 35%, and 24% for the 25-, 50-, and 100-sec conditions, respectively. An equation derived by a multiple regression analysis with the number of previous trials, intertrial intervals, and contraction time as independent variables produced a set of predicted values which correlated .99 with the actual means. This analysis indicated that the fatigue functions may be assumed to b identical in form for the various trials at the different intertrial intervals. Strength was found to be significantly correlated with absolute decrement but not with relative decrement. Author (GRA)

N71-16409# School of Aerospace Medicine, Brooks AFB, Tex.
HEART RATE AS AN INDEX OF NEUROENDOCRINE COMPENSATION DURING SPACE FLIGHT
V. V. Parin et al [1970] 14 p refs Transl. into ENGLISH of Russian Conf. Paper Presented at the 18th Congr. of Intern. Astronaut. Federation, Belgrade, 25 - 30 Sep. 1967
(AD-714405; SAM-TT-R-945-0670) Avail: NTIS CSCL 6/19

Heart rate is one of the simplest indices to record during space flight. Discovery of a significant sinusoidal arrhythmia in the first cosmonauts during weightlessness gave impetus to the development of mathematical and cybernetic heart rate analysis techniques. An algorithm facilitating automatic physiological control of the cosmonauts has been devised based on heart rhythm. The report presents data on variations in a series of mathematical and statistical indices of cardiac rhythm related to neutroendocrine regulation. Cardiac rhythm is viewed from the point of view of the theory concerning random functions in the form of a series of 100-150 values for cardiac cycle duration. Each of the values is a single manifestation of a random process which may be wholely characterized by a distributive function, by a histogram (variational pulsometry), by an autocorrelational function, or by a spectral function. GRA

N71-16410# School of Aerospace Medicine, Brooks AFB, Tex.
THEORETICAL AND PRACTICAL PHYSIOLOGICAL ASPECTS OF THE BASIC TRAINING OF COSMONAUTS FOR PROLONGED SPACE FLIGHTS [NEKOTORIE FIZIOLOGICAESKIE POLOZHENIYA K RAZRABOTKE TEORETICHESKIKH I PRAKTICHESKIKH OSNOV TRENIROVKI KOSMONAVTA K DLITELNYM POLETAM]
I. M. Khazen [1970] 33 p refs Transl. into ENGLISH of Russian Conf. Paper Presented at the Conf. on Space Med. and Biol., 10 - 12 Nov. 1964
(AD-714404; SAM-TT-R-805-0170) Avail: NTIS CSCL 6/19

Contents: The neuro-glandular system of the digestive apparatus as an indicator of the general physiological responses of the body; Endocrine secretion of serotonin by glands of the digestive apparatus; Extralabyrinthine symptoms of motion sickness; and The influence of acceleration. GRA

N71-16411# Army Aeromedical Research Unit, Fort Rucker, Ala.
PROBLEMS OF ADAPTATION TO LONG RANGE LARGE SCALE AERIAL TROOP DEPLOYMENTS
Stanley C. Knapp Sep. 1970 28 p refs
(AD-714368; USAARL-71-10) Avail: NTIS CSCL 6/16

The paper discusses the demonstrated stresses and adaptation problems during large scale, long range, rapid reaction time, aerial troop deployments. Long range aerial troop transport and deployment is a technological achievement of the 1960s that has influenced and shaped international political thinking and military strategy. Super transport aircraft, capable of around-the-world troop lifts, are important in the military inventory. Careful consideration has been given to the air-crews that operate these aircraft. It is necessary to carefully assess the position, role, and regard for the individual soldier, the passenger, whom all this aviation technology and engineering supports. Author (GRA)

N71-16463# Joint Publications Research Service, Washington, D.C.
MODEL OF A BIOLOGICAL SUBJECT SUITABLE FOR THE CONTROL PROBLEM
R. I. Burlakov et al 1 Feb. 1971 11 p refs Transl. into ENGLISH from Med. Tekhn. (Moscow), no. 4, 1970 p 6 12
(JPRS-52300) Avail: NTIS

Mathematical models of a biological subject suitable for control problems are presented. The solution of the problems of automatic control of the most important and complex processes of medical practice is complicated by the absence of information permitting the construction of simple and adequate mathematical models of the process on the basis of which it would be possible to sensitize the automatic control system. Steps to develop

mathematical simulation of biological subjects and construction of systems to control certain functions of biological subjects are discussed. Author

N71-16484# Joint Publications Research Service, Washington, D.C.
THE QUANTITATIVE AND QUALITATIVE ADEQUACY OF FOOD RATIONS
I. M. Buznik 20 Jan. 1971 7 p refs Transl. into ENGLISH from Voenno-Med. Zh. (Moscow), no. 1, 1970 p 54-57
(JPRS-52208) Avail: NTIS

The physiological effects of diets as related to the activities of the individual are discussed. The indices of metabolism are evaluated with a consideration of the quantitative and qualitative adequacy of the diet. Accurate information on the actual energy expenditures of individuals is required in order to determine the adequacy of the diet. Author

N71-16488*# George Washington Univ. Washington, D.C. Medical Center.
TECHNOLOGY APPLICATIONS Semiannual Project Report, 1 Jun.-30 Nov. 1970
Jan. 1971 111 p
(Contract NASw-2055)
(NASA-CR-116130) Avail: NTIS CSCL 06B

A qualitative overview is presented of the Application Team Program and its role as a major operational project, sponsored by the TU Office, for facilitating a systematic, continuing transfer of technology. In this activity, the teams involved are cooperating with over 100 organizations, professional groups, and medical research and clinical centers in joint problem solving efforts which facilitate applications of aerospace developments and expertise for broad public benefit. Specific achievements of the Applications Teams over a 6-month period are described along with several program support activities designed to assist NASA and the Applications Teams in their technology transfer efforts. D.L.G.

N71-16520# Joint Publications Research Service, Washington, D.C.
PROBLEMS OF SPACE FLIGHT
2 Feb. 1971 31 p Transl. into ENGLISH from various Russian publications
(JPRS-52309) Avail: NTIS

CONTENTS:

1. THE PROBLEM OF WEIGHTLESSNESS AND HYPODYNAMIA p 1-18 (See N71-16521 06-04)
2. RADIATION HAZARDS IN SPACE FLIGHT p 19-24 (See N71-16522 06-29)
3. MEDICAL AID ABOARD SPACECRAFT T. Krupina et al p 25-27 (See N71-16523 06-04)
4. PROBLEM OF NUTRITION IN SPACE FLIGHT V. Yefimov et al p 27-29 (See N71-16524 06-04)

N71-16521# Joint Publications Research Service, Washington, D.C.
THE PROBLEM OF WEIGHTLESSNESS AND HYPODYNAMIA
In its Probl. of Space Flight 2 Feb. 1971 p 1-18 (See N71-16520 06-04)
Avail: NTIS

Weightlessness was simulated by prolonged stay in a prone position under condition of hypodynamia in order to evaluate its prolonged effects on man during space flight. Observed were the different shifts produced in the body systems, from reduced muscular activity to physical and mental working capacity. Regulations of positions and locomotions, the stability of the kinetic functions, and the rationing of muscular efforts in limited space and under space flight conditions are discussed. It is concluded that after some time the cosmonaut evidently adapts to weightless conditions and that his body forms a number of protective-adaptive mechanisms if life-support systems on the spacecraft maintain proper conditions for gas composition, temperature, humidity, and atmospheric pressure and the cosmonauts prepared physically and mentally for the prolonged flight. G.G.

N71-16523# Joint Publications Research Service, Washington, D.C.
MEDICAL AID ABOARD SPACECRAFT
T. Krupina et al *In its* Probl. of Space Flight 2 Feb. 1971 p 25-27 Transl. into ENGLISH from Sov. Rossiya (Moscow), 18 Jun. 1970 p 4 (See N71-16520 06-04)
Avail: NTIS

The described medicine chest for astronauts contains medicines in tablet form, solutions for injections in special tubes, ointments, etc. Medications constitute treatment against infection, tranquilizers, analgesics, drugs for the cardiovascular system, the gastrointestinal tract, and other possible disorders. Besides therapeutical measures, prophylactic measures during selection, training, and space flight conditions are recommended. G.G.

N71-16524# Joint Publications Research Service, Washington, D.C.
PROBLEM OF NUTRITION IN SPACE FLIGHT
V. Yefimov et al *In its* Probl. of Space Flight 2 Feb. 1971 p 27-29 Transl. into ENGLISH from Komsomolskaya Znamya (Kiev), 16 Sep. 1970 p 3 (See N71-16520 06-04)
Avail: NTIS

Space flight nutritional requirements insure a daily caloric count of about 2,800 cal per person for the crews of multiman spaceships; the weight of the food, its packaging, and its volume are limited. Daily food supply is represented by preserved dishes in aluminum tubes and cans of a wide variety; preserved meats are supplemented by ham, sausage meat, minced pork with egg, and pate. Bread products constitute common and rye bread as well as honeycakes. Also included in the menues are chocolates and candies prepared in bite sizes and packaged in polymeric films. Several dried fruits complete the selection. G.G.

N71-16540# Joint Publications Research Service, Washington, D.C.
CHARACTERISTICS OF FLIER'S BEHAVIOR UNDER COMPLICATED FLIGHT CONDITIONS
N. D. Zavalova et al 25 Jan. 1971 14 p refs Transl. into ENGLISH from Vopr. Psikhologii (Moscow), no. 5, 1970 p 110-121
(JPRS-52233) Avail: NTIS

The behavior of fliers in emergency situations that may develop during flight was studied to develop qualities insuring adequate responses by pilots in flight training. The model used to complicate the situation during flight was action on the lateral controls (while on automatic pilot) which caused the plane to rotate about its longitudinal axis at an angular velocity of 70 deg per second. The dynamics of physiological functions during the malfunction, the skill in coping with emergencies, and characteristics of a flier's behavior in the decision-making process are discussed. It is concluded that emergency situations should be simulated to train fliers to respond to unusual circumstances. F.O.S.

N71-16541# Joint Publications Research Service, Washington, D.C.
THE STRUCTURE OF HUMAN THINKING ACTIVITY
O. K. Tikhomirov 18 Jan. 1971 89 p refs Transl. into ENGLISH from the book 'Struktura Myslitelnoy Deyatelnosti Cheloveka'

Moscow, Univ. Printing House, 1969 p 3-4, 232-304
(JPRS-52199) Avail: NTIS

The relationship between the cybernetic and psychological approaches to human thought are studied to derive ways of constructing a general theory for the activity of living systems. Impairments of the processes of solving problems requiring thought, and the problem of thought in engineering psychology are discussed. Thought is defined as an activity involved in problem solving which produces results after a search, and like other mental processes can be regarded as an information process. F.O.S.

N71-16702*# Public Health Service Hospital, San Francisco, Calif. Medical Dept.

A STUDY OF THE ROLE OF EXTRAVASCULAR DEHYDRATION IN THE PRODUCTION OF CARDIOVASCULAR DECONDITIONING BY SIMULATED WEIGHTLESSNESS (BEDREST), PART 1 Final Report

Kenneth H. Hyatt, William M. Smith, John M. Vogel, Robert W. Sullivan, William R. Vetter et al Dec. 1970 72 p refs
(NASA Order T-68099-G)
(NASA-CR-114808) Avail: NTIS CSCL 06P

Extravascular dehydration occurring during bedrest with resultant loss of plasma water to the extravascular tissues of the lower extremities during the post-recumbency tilt was investigated. Healthy male volunteers underwent a 14 day ambulant control phase, a 28 day bedrest phase, and a 14 day ambulant recovery phase. Details are given on the biochemical and isotopic analyses, dietary control, 70 deg tilt and exercise studies, and pulmonary function studies. The following conclusions were reached: The orthostatic tolerance decrease is not caused by autonomic insufficiency, extravascular dehydration, increased venous pooling, or increase in plasma water transudation. Past-recumbency orthostatism is affected by extracellular volume during bedrest coupled with an unchanged plasma water transudation during post-recumbency tilting. Initial large saluresis and diuresis, and rapid restitution of plasma volume and extracellular fluid voume to normal after bedrest are related to alterations in aldosterone production. A decrease in myocardial function, depressed red cell production by bone marrow, and calcium loss were observed. N.E.N.

N71-16703*# Public Health Service Hospital, San Francisco, Calif. Medical Dept.

A STUDY OF THE ROLE OF EXTRAVASCULAR DEHYDRATION IN THE PRODUCTION OF CARDIOVASCULAR DECONDITIONING BY SIMULATED WEIGHTLESSNESS (BEDREST), PART 2 Final Report

Kenneth H. Hyatt, William M. Smith, John M. Vogel, Robert W. Sullivan, William R. Vetter et al Dec. 1970 152 p
(NASA Order T-68099(G))
(NASA-CR-114809) Avail: NTIS CSCL 06P

Data tables are presented for the biochemical and isotopic analyses, tilt and exercise studies, and pulmonary function studies. N.E.N.

N71-16704*# Little (Arthur D.), Inc., Cambridge, Mass.

A STUDY OF THE EFFECTS OF THE SPACECRAFT ENVIRONMENT ON DRUG ACTION Final Report, 1 Jul. 1969 31 Oct. 1970

31 Oct. 1970 108 p refs
(Contract NAS9-9806)
(NASA-CR-114821) Avail: NTIS CSCL 06P

A study of possible effects of 5 psia oxygen on oxidative drug metabolism has been carried out in the rat. Several drugs in the Apollo medical kit were studied. Exposures to 5 psia oxygen of approximately four, eight, twelve, and twenty-eight days were carried out. This environment had no effect on liver size, amount of liver microsomal protein, or cytochrome P-450 and cytochrome b sub 5 levels in the rat liver. In vitro metabolic rates for oxidation of the following materials were studied using rat liver microsomes from rats exposed to 5 psia oxygen: (1) meperidine, (2) propoxyphen, (3) cyclizine, (4) hexobarbital, and (5) aniline. Use of the first three substrates provides a measure of microsomal N-demethylase activity, hexobarbital provides a measure of barbiturate oxidase activity, and aniline provides a measure of activity of an aryl hydroxylase. From Lineweaver-Burk plots of the rate data, the kinetic parameters K sub m and V sub max were obtained for most of these substrates. No differences in oxidative metabolic rates were found between oxygen-exposed groups and control groups of rats. Author

N71-16736*# Miami Valley Hospital, Dayton, Ohio. Dept. of Research.

THE EFFECT OF A LIQUID FOOD DIET ON HUMAN SUBJECTS IN A LIFE SUPPORT SYSTEMS EVALUATOR Final Report, 5 Apr.-18 May 1965

Bernard J. Katchman, George M. Homer, James P. F. Murphy, Carol A. Linder, and Vickie R. Must Wright-Patterson AFB, Ohio. AMRL Jul. 1970 64 p refs
(NASA-Order R-85; Contract AF 33(657)-11716)
(NASA-CR-116253; AD-711790; AMRL-TR-67-76) Avail: NTIS CSCL 06P

A 6-week study with four college students as volunteer subjects was conducted for the purpose of evaluating the water, caloric and protein requirements of individuals undergoing simulated stresses of aerospace conditions. During this time the subjects spent 28 days in the Life Support Systems Evaluator. Two subjects wore the MA-10 space suit, unpressurized for 24 hours a day. The subjects ate a 1-cycle, 4 meals per day fresh food diet and a 3-cycle, 4 meals per day liquid food diet. The only variety in the fresh food diet was the meat and fruit served at each meal. This diet was acceptable and did not show monotony even after 21 days. The fresh food diet was comprised of 63 g protein, 150 g fat, 204 g carbohydrate and 2372 kcal energy. The liquid food diet was composed of 70 g protein, 167 g fat, 246 kcal energy. The daily requirement of water was about 2700 ml for both diets. Author (GRA)

N71-16793# Chicago Univ., Ill.

HIGH RESOLUTION SCANNING MICROSCOPY OF BIOLOGICAL SPECIMENS

A. V. Crewe [1970] 27 p refs Presented at Conf. on Electron Microscopy, London
(Contract AT(11-1)-1721)
(COO-1721-21; CONF-700332-1) Avail: NTIS

A scanning microscope is described which is capable of a point resolution of 5 A. It can produce the same kinds of micrographs as a conventional microscope. However, by using several detectors to produce signals corresponding to different groups of transmitted electrons, an image contrast closely proportional to Z, the atomic number is produced. Such a system is very promising for the study of stained molecules. Author (NSA)

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N71-15749# Naval Research Lab., Washington, D.C.

USE OF LiF TEFLON DISCS IN LAMINATED IDENTIFICATION PASSES FOR PERSONNEL ACCIDENT DOSIMETRY

A. E. Nash and F. H. Attix *In it.* Rept. of NRL Progr., Oct. 1970 p 11 15 refs (See N71-15747 06-24)
Avail: NTIS CSCL 18F

The application of LiF-Teflon disks laminated between the plastic layers of an identification pass is described. Pairs of (Li-7)F and (Li-8)F disks are employed to provide some neutron detection capability. The disks are each 6 millimeters in diameter and 0.13 millimeter in thickness, and the pair is wrapped in aluminum foil to avoid sticking to the lamination and generation of spurious thermoluminescent signals. Author

N71-15832*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTENSIVE CARE ALARM INDICATOR SYSTEM Final Technical Report, 22 Jun. 28 Aug. 1970
J. Lauris Christensen and Andre L. Hebert Jan. 1971 36 p refs
(NASA-TM-X-65421; X-207-71-10) Avail: NTIS CSCL 06B

Based on observations of the nurse alerting system in the Intensive Care Unit of three hospitals, a recommendation is submitted for an inductive loop system with an audible signal. The device would be worn by the staff responsible for care, usually within the immediate area of room, and would indicate when alarms on monitoring equipment are activated. A diagram of the prototype loop system is presented. The floor plan, type of interface, amplifier output, and packaging of the receiver are some of the variables which must be established prior to final installation at each location. It should be noted that attempts to use existing equipment were successful; the equipment is relatively inexpensive, and, in the case of the receiver, already in a miniaturized form. The emphasis is on the development of the alarm device. E.M.C.

N71-15848*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PHONOCARDIOGRAPHIC PREPROCESSOR Final Technical Report, 22 Jun. 28 Aug. 1970
Mohammad Ali Hooshmand and Robert Martino Jan. 1971 20 p refs
(NASA-TM-X-65420; X-207-71-9) Avail: NTIS CSCL 06B

Progress is reported on the development of a phonocardiographic preprocessor which gives the physician a picture of what he hears, and gives the computer a waveform that can be easily stored and analyzed. A breadboard circuit consisting of a full wave rectifier with simple resistance capacity filtering was successfully demonstrated. Actual phonocardiographic recording on 1/4 inch magnetic tape was used to develop the circuit. E.M.C.

N71-15895*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SUMMER INSTITUTE FOR BIOMEDICAL RESEARCH IN TECHNOLOGY UTILIZATION Final Administrative and Technical Report, 22 Jun. 28 Aug. 1970
Wayne T. Chen Jan. 1971 142 p refs Conf. held in Greenbelt, Md.; sponsored by NASA. Goddard Space Flight Center
(NASA-TM-X-65418; X-207-71-6) Avail: NTIS CSCL 06B

The technical results and the administrative procedures of the program are presented. Undergraduate engineering and science students cooperated in utilizing NASA's technology for developing medical diagnostic monitoring instrumentation. Research is reported in the following areas: electrocardiographic electrodes for rapid application; heart sound microphone miniaturization; phonocardiographic preprocessor; intensive care alarm indicator system; and digital realization of pulmonary screening and motivating spirometer. N.E.N.

N71-15896*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DIGITAL REALIZATION OF PULMONARY SCREENING AND MOTIVATING DEVICE Final Technical Report, 22 Jun. 28 Aug. 1970
Israel F. Charo and Donald Goralick Aug. 1970 12 p
(NASA-TM-X-65417; X-207-70-475) Avail: NTIS CSCL 06B

The digital logic design was developed for duplicating the concept of the spirometer, and a breadboard model was fabricated. The computer was made to evaluate Kory's equation correctly, and the Kory regression module was digitized. N.E.N.

N71-15985# Los Alamos Scientific Lab., N.Mex.
COMPARATIVE TESTS OF FINE-DUST MASKS
Fritz Regenberg 1970 8 p refs Transl. into ENGLISH from Atemschutz-Inform., v. 8, no. 3, 1969 p 66 71
(LA-4459-TR) Avail: NTIS

Comparative tests were carried out with several dust masks. Not all of the models responded to the specifications concerning the degree of dust removal. Author (NSA)

N71-15993# McElroy (Ralph) Co., Austin, Tex. Custom Div.
AIRTIGHT FIT OF RESPIRATORY PROTECTION MASKS
G. Aurich [1970] 10 p refs Transl. into ENGLISH from Atemschutz-Inform., v. 8, no. 2, 1969 p 32 36 Prepared for Los Alamos Scientific Lab.
(LA-TR-70-17) Avail: NTIS

The problems of a tight sealing fit of face masks are of equal importance with respect to the efficiency of devices of respiratory protection as the problems of their functioning. The efficiency of devices for respiratory protection is more limited by insufficient sealing than by functional failure or other leaks. An optimal fit of the mask is the prerequisite for a satisfactory seal between mask and face of the bearer of the device. Fit and sealing are in close correlation because adequate sealing with tolerable inconvenience may only be achieved with a good-fitting mask. Fit and sealing of face masks are determined by the ratio between the dimensions and the shape of the mask and the shape and the dimensions of the bearer of the device, by the shape and the material of the sealing frame, by the tape-lapping, and by the forces and moments exerted by the accessories which are attached to it. Author (NSA)

N71-15994# Naval Civil Engineering Lab., Port Hueneme, Calif.
AIR REVITALIZATION UNIT FOR SEALED SURVIVAL SHELTERS Technical Report, Jul. 1965 Jun. 1969
D. E. Williams Oct. 1970 57 p refs
(AD-714163; NCEL-TR-697) Avail: NTIS CSCL 6/11

An air revitalization unit for use with sealed survival shelters without an external power supply was developed. The unit is capable of supplying oxygen to and removing carbon dioxide and odors from a 100-man personnel shelter for a 24-hour period. The system utilizes (1) a dry chemical absorbent (Baralyme) for carbon dioxide removal, (2) pressure cylinders for the oxygen supply, (3) an activated charcoal filter to remove odors, and (4) a battery-powered fan for air circulation. A prototype unit was designed, fabricated, and tested. Following tests of individual components, a 24-hour continuous test of the unit was completed. In general, the test results for the chemical, mechanical, and structural aspects of the air revitalization unit were affirmative. A similar assessment cannot be made for the human element inherently involved with the operation of the unit. Author (GRA)

N71-15995# RAND Corp., Santa Monica, Calif.
NOTES ON PERCEPTUAL GEOMETRIES
Fred S. Roberts Jul. 1970 21 p refs Presented at the Workshop on Perceptual Geometries, Miami, Fla., 26 Aug. 1 Sep. 1970; sponsored by NSF
(AD-714106; P-4423) Avail: NTIS CSCL 6/16

The purpose of the document is first of all to standardize some terminology useful for describing models of perceptual geometry. Using this terminology, certain models are very briefly described, some very limited experimental data are discussed, and rather general open questions are posed. Author (GRA)

N71-15996# Human Engineering Labs., Aberdeen Proving Ground, Md.
STANDARDIZATION OF TASKS AND MEASURES FOR HUMAN FACTORS RESEARCH
1970 113 p refs Proc. of a Conf. held at Lubbock, Tex., 18–19 Mar. 1970
(AD-714669; HEL-TM-19-70) Avail: NTIS CSCL 5/5

Contents: Is standardization necessary in human factors research; Data requirements for operational performance prediction; An approach to standarizing human performance assessment; Use of the synthetic-work technique in the assessment of sustained performance; Specification and measurement of intragroup coordination in various types of tasks and work groups; Considerations of fatness and body compositon in evaluating physical fitness and performance; and Physical and physiological measurements--are they interchangeable. GRA

N71-16097# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RED STAR, NUMBER 240, 1969: SELECTED ARTICLES
M. Rebrov et al 13 Aug. 1970 38 p Transl. into ENGLISH from Krasnaya Zvazda (USSR), no. 240, 1969 p 3–4
(AD-714771; FTD-HT-23-406-70) Avail: NTIS CSCL 5/9

The article gives some brief intimate details of the lives of the Soviet Cosmonauts who went up in Soyuz-7 and Soyuz-8. Most of the details date back to World War II and prior to it. What motivated the men to become flyers and some of their early school and flying-school experiences are mentioned. Author (GRA)

N71-16153*# Purdue Univ., Lafayette, Ind. Lab. for Agricultural Remote Sensing.
BIOPHYSICAL RESEARCH AT LARS-PURDUE
Roger M. Hoffer *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 2 1968 28 p (See N71-16147 06-13)
Avail: NTIS CSCL 06C

The Laboratory for Agricultural Remote Sensing (LARS) was founded to plan and conduct research on data collection, data processing, and data distribution techniques which permit the rapid collection of accurate information important to the management of agricultural resources. Much of the work at LARS has centered around photographic and multispectral optical-mechanical scanner data. The primary advantage of optical-mechanical scanner data is in the ease and accuracy with which the data can be quantized and then processed and analyzed by computer. The advantages of automatic data processing of operational remote sensed information in agriculture would be the capability of obtaining data rapidly over large geographical areas and the timely processing of such data to useful information with accompanying benefit in improved accuracy, timeliness, and possible economy of agricultural surveys. A.L.

N71-16251# Texas Christian Univ., Fort Worth. Inst. for the Study of Cognitive Systems.
PARAMETERS OF HUMAN PATTERN PERCEPTION Annotated Bibliography of Reports, Sep. 1967 Aug. 1970
Selby H. Evans Aberdeen Proving Ground, Md. Human Eng. Labs. Oct. 1970 24 p refs
(Contract DAAD05-68-C-0176; Proj. Themis)
(AD-714672) Avail: NTIS CSCL 5/10

Abstracts of reports resulting from a research project on human pattern perception are collected in the bibliography. Journal publications, technical memorandums, theses, and dissertations are included. Author (GRA)

N71-16285# Massachusetts Inst. of Tech., Cambridge.
LEARNING STRUCTURAL DESCRIPTIONS FROM EXAMPLES
Patrick H. Winston (Ph.D. Thesis) Sep. 1970 268 p refs
(Contract Nonr-4102(02))
(AD-713988; MAC-TR-76) Avail: NTIS CSCL 9/2

The research described centers on how a machine can recognize concepts and learn concepts to be recognized. Explanations are found in computer programs that build and manipulate abstract descriptions of scenes such as those children construct from toy blocks. One program uses sample scenes to create models of simple configurations like the three-brick arch. Another uses the resulting models in making identifications. Throughout emphasis is given to the importance of using good descriptions when exploring how machines can come to perceive and understand the visual environment. Author (GRA)

N71-16299# Texas Technological Univ., Lubbock. Center of Biotechnology and Human Performance.
PERFORMANCE, RECOVERY, AND MAN-MACHINE EFFECTIVENESS Semiannual Progress Report, 1 Mar.–31 Aug. 1970
Richard A. Dudek 15 Sep. 1970 28 p refs
(Contract DAAD05-69-C-0102; Proj-Themis)
(AD-714375) Avail: NTIS CSCL 5/8

The purpose of this program is the generation of basic data concerning human performance and recovery within several work systems settings under conditions of varied environments, task demands, motivational levels, and nutritional factors. Further, to generate from this basic data the solution to real problems and recommended procedures for mans operation under varying conditions of the work system, e.g., work-facilitating period combinations for various task types, duration of tasks, environments, etc., determination operations, procedures, and methods for improved team operations, optimal work-rest schedules for crews of vehicles creating a vibrational environment, etc. The task model described in the previous report has been revised slighly in order to more fully encompass the work activities of man. The classification continuum of human work has been extended to include man as a social interactor when mans primary function is to perform within a group with minimal machine interaction. With this addition, activities of work where men are required to make judgements are included in the task model. Author (GRA)

N71-16351# Computer Research Corp., Newton, Mass.
MAN-COMPUTER INTERACTION AND CONTEXT PROGRAMMING Final Report
Lewis C. Clapp Jul. 1970 52 p refs
(Contract Nonr-4861(00))
(AD-714232; R102-6) Avail: NTIS CSCL 9/2

The report is concerned with the communication between man and the computer systems he uses for problem solving and management planning. To bridge the gap between problem solving needs and the ability of problem solvers to write their own programs, the trend has been to create pre-packaged programs which can solve a class of problems once the pertinent data has been supplied. One impediment toward the development of better problem solving tools which will operate in conjunction with on-line computer systems is a methodology for structuring the dialogue between the problem solver and his machine. A series of generalized

dialogue handling routines was programmed for a time-sharing system operating on a Scientific Data Systems computer (SDS-940) The general set of routines is called the Command Package. The Command Package is then used in several different applications areas drawn from mathematics, engineering, and general modeling and simulation. Author (GRA)

N71-16396# Sandia Corp., Albuquerque, N.Mex.
DEVELOPMENT OF A HUMAN ERROR RATE DATA BANK
A. D. Swain Jul. 1970 5 p refs Presented at US Navy Human Reliability Workshop, Washington, D.C., 22 - 23 Jul. 1970 Sponsored in part by AEC and Navy
(SC-R-70-4286; CONF-700704-1) Avail: NTIS

A program to develop a human error rate data bank for use by system planners and designers and by human reliability analysts and human engineering specialists is described. The point of view is taken that sufficient work has been done in reliability technology (including the mathematical modeling) and in behavior classification (task taxonomy) so that an interim human performance data bank can be initiated almost immediately. A procedure for establishing a noncomputerized, manual entry, interim human performance data bank is outlined. The basic criterion variable suggested is the human error rate. A method of identifying and scaling the independent variables (called performance shaping factors) is presented. An approach for refining and validating the data bank is described. Validation includes using multivariate analysis techniques to find out what performance shaping factors have maximum postdictive power for various types of equipment/task combinations for which human error rate data was collected. It is questioned whether the gains realized from automatic, high-speed data retrieval would be worth the added complexity (and related unreliability and down time) of a computerized data bank and the time, effort, and costs of developing and maintaining it. Author (NSA)

N71-16446# Naval Ordnance Station, Indian Head, Md.
GEOMETRICAL CONSIDERATIONS INVOLVED IN MILITARY MARKERS FOR SEARCH AND RESCUE
E. W. Anderson and O. H. Dengel 31 Dec. 1969 28 p refs
(AD-713861; IHMR-69-82) Avail: NTIS CSCL 6/7

Calculations are made to determine the intensity of the radiation reflected by signal markers with various geometrical configurations. Recommendations are offered for the optimum signal marker shape for day and night use. Author (GRA)

N71-16477# Illinois Univ., Urbana. Biological Computer Lab.
ACCOMPLISHMENT SUMMARY 1969/1970 OF THE BIOLOGICAL COMPUTER LABORATORY Interim Period, 1 June 1969 - 31 May 1970
H. Von Foerster 15 Jul. 1970 343 p refs
(Grant AF-AFOSR-1865-70)
(AD-714608; BCL-70.2; AFOSR-70-2595TR) Avail: NTIS CSCL 6/4

The theories of multi-valued mathematics and transclassical logic have been advanced. Methods for axiomatizing and describing cognition are proposed. The properties of complex dynamic systems have been investigated. A novel structure for classifying data is described and applications discussed. The properties of speech, vision, neurons and movements are investigated. Various devices have been constructed which are computational principles based on living organisms. GRA

N71-16506*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
REACTION TIMES OF SUBJECTS IN TESTS WITH DISPLAY-CONTROL CONFIGURATIONS TYPICAL OF THOSE USED IN CONTINUOUS TRACKING TASKS
Walter W. Hankins, III and Patrick A. Gainer Washington Feb. 1971 26 p refs
(NASA-TN-D-6132; L-7034) Avail: NTIS CSCL 06B

Reaction times of human subjects to different displays have been measured. Statistical analyses were made of the effects of intersubject variability, direction of display motion, display differences, learning and fatigue, and rates of display indicator motion. Subjects using the same display-control configuration exhibited significantly different response times. Reaction times were found to differ significantly with displays and display indicator rates. Author

N71-16551# Ohio State Univ., Columbus. Dept. of Electrical Engineering.
A STUDY OF REGULARLY REALIZABLE GAIT MATRICES
Anil Kumar Jain (M.S. Thesis) 1970 63 p refs
(Grant AF-AFOSR-1901-70)
(AD-714592; AFOSR-70-2583TR) Avail: NTIS CSCL 6/2

A gait of an n-legged machine or animal can be represented by a binary matrix, called a gait matrix, in which each row specifies the succession of leg states involved in the gait. By convention, a leg is said to be in the 0-state when it is in contact with the ground and in the 1-state when it is raised above it. A specific gait matrix is regularly realizable if and only if it is possible to execute the gait with every leg spending the same amount of time in the 0-state as every other leg. The report presents some general properties of such matrices. Both a sufficient condition and a necessary condition for regular realizability is obtained for a general n-legged machine. For quadrupeds and bipeds, a single condition which is both necessary and sufficient is found and it is determined that a total of 4 nonsingular biped gaits and 480 nonsingular quadruped gaits are regularly realizable. Author (GRA)

N71-16552# Ohio State Univ., Columbus. Dept. of Electrical Engineering.
A MATHEMATICAL THEORY FOR LEGGED LOCOMOTION SYSTEMS
Robert B. McGhee [1970] 14 p refs Presented at the 1970 Midwest Symp. on Circuit Theory
(Grant AF-AFOSR-1901-70)
(AD-714591; AFOSR-70-2581TR) Avail: NTIS CSCL 6/2

While legged locomotion systems typically possess a large number of degrees of freedom and are inherently very non-linear, it is nevertheless possible to construct a mathematical theory powerful enough to produce results not obtainable by informal methods. Although the present theory is not very far advanced, a framework suitable for the organization of further research has been established. Continued efforts to extend and improve the current understanding of legged locomotion should eventually produce a useful theoretical basis for the design and analysis of legged vehicles and prosthetic and orthotic appliances. Author (GRA)

N71-16553# Ohio State Univ., Columbus. Dept. of Electrical Engineering.
ON THE DYNAMIC STABILITY OF LEGGED LOCOMOTION SYSTEMS
Robert B. McGhee and Mark B. Kuhner 23 Oct. 1970 21 p refs Presented at the 3d Intern. Symp. on External Control of Human Extremities, Bubrovnik, Yugoslavia, 1969
(Grant AF-AFOSR-1018-67)
(AD-714589; AFOSR-70-2580TR) Avail: NTIS CSCL 6/2

While legged locomotion is obviously very efficient and versatile and is widely encountered in nature, only limited success has been attained in constructing legged vehicles. The failure of such vehicles to appear is to a large extent due to the lack of a well developed mathematical theory of legged locomotion. Another

manifestation of this lack is the absence of electronically controlled lower extremity prostheses and orthotic devices. The purpose of this paper is to summarize the available body of theoretical knowledge relating to stability and control in legged machines and animals and to suggest areas where additional research ought to be undertaken. The paper includes a discussion of a hierarchy of mathematical models beginning with finite state models and concluding with rigid body dynamics. Some new results on balancing mechanisms for inherently unstable systems are also included. Author (GRA)

N71-16619# Mound Lab., Miamisburg, Ohio.
LIFE SUPPORT 2 PROGRAM Final Report
N. E. Davis and E. W. Johnson 28 Oct. 1970 50 p refs
(Contract AT-33-1-GEN-53)
(MLM-1757) Avail: NTIS

Five radioisotope-powered heat sources fueled with Pu-238O2 microspheres were fabricated at Mound Laboratory for use in the Life Support 2 Program. Four of the heat sources had a thermal power of 73.5 W each, and the fifth source had a thermal power of 48 W. These heat sources provided energy for operating the Life Support 2 water reclamation system. This system was satisfactorily operated for approximately 70 days total test time. The system, including the five heat sources, will be operating during the 90-day manned chamber tests in the Space Station Simulator at McDonnell-Douglas, Huntington Beach, California. Author (NSA)

N71-16624# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE EFFECTS OF INPUT POWER SPECTRA ON HUMAN OPERATOR COMPENSATORY TRACKING
John C. Heifferon (M.S. Thesis) Mar. 1970 98 p refs
(AD-714130; GE/EE/70-11) Avail: NTIS CSCL 5/10

An investigation is made into the effect on mean-squared error, as a performance measure in a single-axis compensatory tracking task, due to changes in the shape of the input power spectral density. Quasi-linear describing function theory is used to predict normalized mean-squared error with the pilot-vehicle dynamics represented by the crossover model. A digital computer program is used to evaluate the resultant mean-squared integrals and to plot normalized mean-squared error as a function of input and crossover model parameters. The effect on human operator performance due to an added low-amplitude high frequency extension to a near-rectangular input spectrum is studied. Author (GRA)

N71-16709# Maryland Univ., College Park.
ORGANIZATION BEHAVIOR AND DESIGN: PERSPECTIVES AND PERCEPTIONS
Victor F. Phillips, Jr. Oct. 1970 118 p refs Presented at the Symp. on Organizational Behavior in the Air Force, Colo. Springs, Colo., 11 -12 Aug. 1969
(Contract F44620-67-C-0093)
(AD-714597; AFOSR-70-2310TR) Avail: NTIS CSCL 5/10

The document reports on seven papers presented at a symposium on organizational behavior in the Air Force, concerned with scientific research being conducted by or with the support of various Air Force organizations in organizational behavior patterns and trends. Author (GRA)

N71-16840*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ELECTROCARDIOGRAPHIC ELECTRODES FOR RAPID APPLICATION Final Technical Report
Mitchell Weisberg and Rolfe D. White Jan. 1971 18 p refs
(NASA-TM-X-65438; X-207-71-32) Avail: NTIS CSCL 06B

Basic research aimed at the development of an electrode for rapid application is reviewed. The following areas of the investigation are reported: (1) identification and scope of the project, (2) results of a literature search, (3) construction and breadboarding of buffer amplifiers and electrodes, and (4) fabrication techniques for electrodes including an anodizing procedure for tantalum. D.L.G.

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N71-15829# Royal Aircraft Establishment, Farnborough (England).
IONIZATION AND DISSOCIATION OF SOME PYROMELLITIMIDES UNDER ELECTRON-IMPACT
J. L. Cotter and R. A. Dine-Hart Mar. 1970 24 p refs
(RAE-TR-70047) Copyright. Avail: NTIS

The mass spectra of 23 pyromellitimides are reported and discussed. Proposed ion structures are, in most cases, substantiated by precise mass measurement. All compounds examined exhibited molecular ions and peaks at m/e 102. Ions formed by the loss of carbon dioxide from the molecular ions, although abundant in some cases, were not common to all the spectra. Author (ESRO)

N71-15830*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FORTRAN 4 PROGRAM FOR STUDYING ION POLAR MOLECULE COLLISIONS
R. Bruce Canright, Jr. and John V. Dugan, Jr. Washington Jan. 1971 57 p refs
(NASA-TM-X-2151; E-5832) Avail: NTIS CSCL 20H

Ion - polar-molecule collisions have been studied by numerically integrating their approximate equations of motion on a digital computer. A FORTRAN IV program is presented to do this integration (using conservation of energy as a step-size control) and to give results in the form of collision statistics, microfilm plots, and motion pictures of trajectories. Included are the description of the ion-molecule system, the form of the input and output, the functions of the main program and subroutines, the COMMON structure, a sample case, and the complete FORTRAN IV listings. Author

N71-15919# Bristol Univ. (England). Dept. of Inorganic Chemistry.
ORGANOMETALLIC CHEMISTRY Final Report, 1 Oct. 1968 30 Sep. 1970
F. G. A. Stone 15 Oct. 1970 20 p refs
(Contract F61052-69-C-0011)
(AD-714623; AFOSR-70-2560TR) Avail: NTIS CSCL 7/2

Studies were made in several areas of organometallic chemistry, and in one area of high temperature chemistry. The main research effort concentrated on Fluorocarbon complexes of transition metals, Carbonyl complexes of transition metals of 4d and 5d series. New chemistry of organo-derivatives of boron, silicon, germanium, and tin. The high temperature work involved the discovery that carbon atoms, generated from an arc, react with fluoroolefins to yield fluoro-allenes. A bibliography of the 18 publications so far produced during the course of the research forms part of the Report. Author (TAB)

N71-15924*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
QUANTUM THEORY OF DENSITY CORRECTIONS TO THE GASEOUS TRANSPORT COEFFICIENTS

Dennis Alan Gibboney (Ph.D. Thesis) 16 Oct. 1970 223 p refs
(Grant NGL-50-002-001)
(NASA-CR-116137; WIS-TCI-398) Avail: NTIS CSCL 07D

The first density corrections to the transport coefficients are investigated for the case of a quantum gas of spherical particles. The development is based upon a truncation of the quantum mechanical BBGKY equations. For this purpose, the pair distribution function is expressed in terms of singlet distribution functions through the definition of a quantity Y. The BBGKY hierarchy is then truncated by the approximation that Y may be replaced by its equilibrium value. The first of the BBGKY equations is shown, on the basis of a pair distribution function obtained in this manner, to lead to a quantum mechanical Boltzmann equation which is generalized to include both collisional transfer and three-body contributions. This equation is solved by the method of Chapman and Enskog and expressions obtained for the transport coefficients. Numerical computations for the two-body contributions to the first transport virial coefficients are presented for a quantum gas of rigid spheres. The three-body terms are shown to lead, in the classical limit to the results of Hoffman. Author

N71-15939# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF THE RATE OF MACROMOLECULAR MOVEMENT ON THE COEFFICIENT OF PROGRESSIVE FRICTION
V. P. Budtov 4 Aug. 1970 14 p refs Transl. into ENGLISH from Vestn. Leningr. Univ., Ser. Fiz. i Khim. (Leningrad), v. 24, no. 16, no. 3, 1969 p 58–63
(AD-714745; FTD-HT-23-547-70) Avail: NTIS CSCL 7/4

Navier-Stokes equations for the motion of a sphere in a closed sphere with partial consideration of inertia components are solved. It is shown that by taking into account the inertia components of macromolecules, the friction coefficient will diminish with an increase in velocity. Such variation in the friction coefficient is noted for rigid particles (latexes and polymer chains with high thermodynamic rigidity). Author (GRA)

N71-15980*# Pittsburgh Univ., Pa. Dept. of Physics.
EXCITATION OF THE CO FOURTH POSITIVE BAND SYSTEM BY ELECTRON IMPACT ON CARBON MONOXIDE AND CARBON DIOXIDE
M. J. Mumma, E. J. Stone, and E. C. Zipf Sep. 1970 29 p refs
(Grants NsG-416; NGL-39-011-030; Contract DA-31-124-ARO(D)-440)
(NASA-CR-116141; SRCC-143) Avail: NTIS CSCL 07D

Absolute excitation cross sections were measured for five vibrational bands of the carbon monoxide fourth positive band system. The bands were produced by electron impact on carbon monoxide and carbon dioxide and the cross sections were measured from threshold to 350 eV. Relative intensity measurements on 28 bands were used to determine the dependence of R sub e on the r-centroid. Absolute excitation cross sections for the first five vibrational levels of the A one Pi state were determined for each parent gas using the measured cross sections of specific bands and absolute transition probabilities. The relative populations of the first five vibrational levels were also determined for dissociative excitation of carbon dioxide. Author

N71-15983# Technische Hochschule Hannover (West Germany).
HETEROGENEOUS ISOTOPE EXCHANGE BETWEEN GERMANIUM DIOXIDE AND GASEOUS OXYGEN [HETEROGENER ISOTOPENAUSTAUSCH ZWISCHEN GERMANIUMDIOXID UND GASFOERMIGEN SAUERSTOFF]
Jobst Heinrich Meyer zu Bexten (Ph.D. Thesis) 1970 118 p refs In GERMAN
Avail: NTIS

Isotopic exchanges between hexagonal germanium dioxide and gaseous oxygen at high temperatures were studied by mass spectrometric observations of oxide reactions with O-18 marked 02. Computerized evaluation of lattice oxygen diffusion coefficients and of phase boundary reaction constant values established the temperature and pressure dependency of the diffusion coefficient. Low activation energies and pre-exponential factors indicate participation of polycrystalline grain boundaries in the diffusion process. Transl. by G.G.

N71-16018# Ontario Univ., London. Dept. of Chemistry.
SOME THERMOCHEMICAL STUDIES BY MASS SPECTROMETRY Final Technical Report, Sep. 1966–Sep. 1969
D. R. Bidinosti Oct. 1970 45 p refs
(Grants AF-AFOSR-0977-66; AF-AFOSR-1356-68)
(AD-714105; AFOSR-70-2523-TR) Avail: NTIS CSCL 7/4

The purpose of the reported research was to study selected examples of three classes of chemical reactions in molecular flow reactors at elevated temperatures. In all cases the gaseous contents of the reactors were determined by mass spectrometric analysis of a molecular beam effusing from a small orifice in the reactor. The reactions were: (1) The thermal decomposition of some symmetric compounds containing metal-metal bonds with the object of producing free radicals by the homolytic fission of the metal-metal bond. The compounds studied were: Co2(CO)8, Mn2(CO)10, Re2(CO)10, (MoCp(CO)3)2 (FeCp(CO)2)2 and (NiCpCO)2. (2) The system, BF3 - B2O3, at high temperatures. (3) The dehalogenation of orthodichlorobenzenes on hot graphite surfaces with the object of producing benzynes. Author (GRA)

N71-16071# Office of Naval Research, London (England).
INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY (IUPAC) INTERNATIONAL SYMPOSIUM ON MACROMOLECULAR CHEMISTRY
A. L. Powell 5 Oct. 1970 31 p ref Conf. held at Budapest, 25–30 Aug. 1969
(AD-714031; ONRL-C-24-70) Avail: NTIS CSCL 7/3

The document briefly summarizes the main papers read at the IUPAC polymer symposia. The topics included: Heat resistant plastics, emulsion polymerization, new polymer synthesis using photochemistry, aromatic polyesters, free radical polymerization and complexes, vinyl polymerization with catalysts, and the future possibilities in polymer research. GRA

N71-16117# Emory Univ., Atlanta, Ga. Dept. of Chemistry.
THE SYNTHESIS AND CHARACTERIZATION OF NOVEL COMPOUNDS OF NIOBIUM WITH RELATION TO ENHANCING APPLICATIONS IN MATERIALS Final Report, 1 Oct. 1967–30 Jun. 1970
Ronald C. Johnson Oct. 1970 48 p refs
(Grant AF-AFOSR-1355-68)
(AD-714701; AFOSR-70-2545TR) Avail: NTIS CSCL 7/2

The object of the research program was to improve the general understanding of the chemistry of niobium and tantalum. A variety of the new compounds were synthesized and characterized. One series had the stoichiometry MX2(OCH3)2L where M was Nb or Ta, X was Cl or Br, and L was a beta-diketone or a related molecule. Another series had the stoichiometry MX(OCH3)2L2 where M was Nb or Ta, X was Cl, Br, or NCS, and L was one of several dialkyldithiocarbamates. A third series had the same stoichiometry as the second but L was one of several dialkyldithiophosphates. New compounds with these stoichiometries were also made. MOL3 and ML4Cl, where M was Nb or Ta and L was the anion of tropolone, 8-quinolinol, or

benzoylphenylhydroxylamine. On the basis of the synthetic work and limited kinetic studies it has been possible to develop a better understanding as to which niobium and tantalum compounds are likely to exist and plausible routes to make them. Author (GRA)

N71-16118# Brown Univ., Providence, R.I.
THERMAL DIFFUSION AND OTHER TRANSPORT PHENOMENA IN GASES Final Report, 1 Sep. 1967 – 31 Aug. 1970
E. A. Mason 31 Aug. 1970 4 p refs
(Grant DA-ARO(D)-31-124-G925)
(AD-714690; AROD-7384-12-P) Avail: NTIS CSCL 7/4

A brief summary of the results and reports emanating from an investigation of transport phenomena in gases and their relation to intermolecular forces and molecular collisions is given. Author (GRA)

N71-16275# Naval Research Lab., Washington, D.C.
PROCEDURES FOR THE ANALYSIS OF METALS, ALLOYS, AND OTHER MATERIALS OF RESEARCH. PART 6: PROCEDURES FOR PREPARATION OF SAMPLE SOLUTIONS IN OXALIC ACID FOR SPECTROPHOTOMETRIC DETERMINATION OF TITANIUM Progress Report
Lewis J. Clark Oct. 1970 10 p refs
(AD-713937; NRL-7182) Avail: NTIS CSCL 7/4

The chemical analysis of titanium is complicated by the tendency of its ions to hydrolyze in neutral or slightly acidic solutions. However, in 0.3M oxalic acid, the titanium solutions remain stable and clear because hydrolysis of titanium is prevented. Therefore, sample solutions of various inorganic ions were prepared in oxalic acid to determine titanium. Aliquots of the sample solutions can be taken for the spectrophotometric determination of 0.004% to 10.0% titanium with tiron. The exclusion of fluoride reagents eliminates a source of color interference and a health hazard. Author (GRA)

N71-16314# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THERMODYNAMIC ASPECTS OF THE PROBLEM OF IMMEDIATE CONVERSION OF CHEMICAL ENERGY INTO ELECTRICAL
N. S. Lidorenko et al 21 Aug. 1970 21 p Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Energ. i Transp. (Moscow), no. 6, 1969 p 93 – 101
(AD-713875; FTD-MT-24-114-70) Avail: NTIS CSCL 7/4

The basic aspects of the thermodynamic description of an electrochemical generator were examined. By the thermodynamic methods of balanced processes basic expressions for emf and efficiency of the generator were obtained. The effect of the basic parameters of the working body on generator characteristics were analyzed, and the expressions for optimum temperature, corresponding to maximum efficiency or emf have been found. On the basis of the obtained expressions, the characteristics of the electrochemical generator on a series of possible working bodies were analyzed. The system of equations which described the unbalanced processes in an electrochemical generator were examined. For the generator with an ion-exchange diaphragm on the basis of the accepted model a method of calculating the volt-ampere characteristic is presented. Author (GRA)

N71-16412# General Electric Co., Schenectady, N.Y. Research and Development Center.
SHOCK TUBE STUDIES OF NITROGEN VIBRATIONAL RELAXATION AND METHANE OXIDATION Final Report
Donald R. White Jun. 1970 71 p refs
(Contract AF 33(615)-5274)
(AD-714072; S-70-1054; ARL-70-0107) Avail: NTIS CSCL 7/4

The report summarizes the research performed under this contract in the general areas of vibrational relaxation and shock tube chemistry. The authors have unsuccessfully attempted to generate cylindrical detonations in H2-O2 under conditions such that the reaction zone and shock front could be observed first to separate and hopefully then to reattach. The induction time for methane has been measured over a wide range of pressure, temperature, stoichiometry, and diluent using both incident and reflected shock waves. An activation energy of about 51 kcal/mole is found, larger than that of several other investigators largely due to our observation of longer times at the lower temperatures. In the H2/CO/O2 system the combination of flame and interferometric shock data has earlier proved valuable in selection from among alternative kinetic schemes, but laminar reaction zones have been unattainable in methane oxidation without use of an additive to speed the reaction. Qualitatively, acetone, methyl alcohol, and acetylene all accelerate the reaction to a decreasing extent. Hydrogen has been used as an additive to obtain density profiles adequate for comparison with computed profiles using a complex reaction scheme. A first attempt at computer reconciliation of flame and shock tube data has been made with encouraging results, and changes to be incorporated in the next iteration of the kinetic system have been identified. Author (GRA)

N71-16422# General Telephone and Electronics Labs., Inc., Bayside, N.Y. Bayside Research Center.
EXCITATION AT ELECTRODES Quarterly Status Report
Adam Heller and Kenneth W. French 7 Nov. 1970 4 p refs
(Contract N00014-71-C-0008)
(AD-714235; GT/E-TR-70-838.1; QSR-1) Avail: NTIS CSCL 7/4

Briefly reviewed is research concerned in the demonstration that ions can be produced in the electronically excited rather than in the ground state in electrode reactions. Electroluminescence has been observed in all of the three cations (Th(3+), Eu(3+), and Nd(3+) that have been tried so far. Upon passage of current between electrodes immersed in aprotic solvent solutions of the ions, the terbium-containing solutions emit green light, europium containing solutions emit red, and neodymium containing solutions, infrared. The observed electroluminescence suggests that ions with relatively low-lying excited states are readily produced in the excited state in electrode reactions. The new liquid electroluminescent systems are solutions of rare-earth ions in phosphorus oxychloride acidified with a Lewis acid zirconium tetrachloride. A solution was prepared by adding Tb(CF3COO)3 (or another rare-earth trifluoroacetate) to a solution of zirconium tetrachloride in phosphorus oxychloride. A reaction takes place in which CF3COOl is liberated and the Nd(+3) remains in solution. Author (GRA)

N71-16423# Kentucky Univ., Lexington. Dept. of Chemistry.
CORRECTION FOR SERIES RESISTANCE IN ac POLAROGRAPHY
Sudarshan Lal and H. H. Bauer Aug. 1970 13 p refs
(Contract DAAB07-69-C-0366)
(AD-714255; THEMIS-UK-RR-16) Avail: NTIS CSCL 7/4

The apparent or measured series resistance of an electrochemical cell is influenced by the geometry of the electrodes. At a dropping mercury electrode, the resistance increases as the frequency of the measuring signal decreases. The question arises as to how to correct for the series resistance when calculations are made of the Faradaic impedance. It is shown here that the use of the high-frequency limit of the resistance gives better results than use of the apparent resistance at each frequency. Nevertheless, the correction made in this way represents only an approximation. Author (GRA)

N71-16424# Georgia Inst. of Tech., Atlanta.
CRYOSYNTHESIS AND ENERGETICS OF SOME HIGHLY

REACTIVE SMALL BORON COMPOUNDS AND GENERAL THEORETICAL REACTION KINETICS AT CRYOGENIC TEMPERATURES

Partha Sarathi Ganguli (Ph.D. Thesis) Aug. 1970 133 p refs
(Grant AF-AFOSR-1308-67)
(AD-714627; AFOSR-70-2575TR) Avail: NTIS CSCL 7/2

The work is concerned with an experimental as well as a theoretical study of the cryogenic synthesis of some highly reactive or unstable compounds, and reported in two parts. The first, involves the production of borane and tetraborane-8 by the pyrolysis of borane carbonyl and tetraborane-10 respectively, the determination of the molecular energetics of BH3CO by mass spectrometric techniques and of some B-H-F compounds using the MINDO molecular orbital method. This part also involves the studies of the low temperature stabilization of highly reactive borane and tetraborane-8 by a fast-flow pyrolysis and hard quench technique in a cryogenic reactor-mass spectrometer facility. The second part, develops a general theoretical reaction formalism for kinetic computations using Molecular Orbital methods to study the useful existence of some highly reactive or unstable compounds at cryogenic temperatures. Author (GRA)

N71-16470*# National Aeronautics and Space Administration, Washington, D.C.

STUDIES ON THE SYNTHESIS AND UTILIZATION OF FORMOSE. PART 1: SUGAR FORMATION BY THE FORMALDYHYDE CONDENSATION IN THE PRESENCE OF INORGANIC AND ORGANIC BASES

Takashi Mizuno et al Jan. 1971 15 p refs Transl. into ENGLISH from Nippon Nogeikagaku Kaishi (Tokyo), v. 44, no. 7, 1970 p 324–331
(NASA-TT-F-13410) Avail: NTIS CSCL 07C

The formation of formose with regard to organic and inorganic bases is discussed. The production of formose is accomplished through the aldol condensation of formaldehyde in an aqueous solution in the presence of a base catalyst. The formose thus produced contains more than thirty varieties of monosaccharides with various carbon values. Author

N71-16476*# Scientific Translation Service, Ann Arbor, Mich.

AROMATIC CYANATE ESTERS AS THE BASIS FOR NEW RESINS IN LAMINATION TECHNOLOGY [AROMATISCHE CYANSAEUREESTER ALS GRUNDSTOFF FUER NEUE HARZE IN DER LAMINIERTECHNIK]

R. Kubens et al Washington NASA Jan. 1971 25 p refs Transl. into ENGLISH from Kunstst. (Munich), v. 58, no. 12, 1968 p 827–832
(Contract NASw-2035)
(NASA-TT-F-13454) Avail: NTIS CSCL 7/4

Aromatic esters of cyanic acid are studied for applications above 200 C by converting them to duomeric products. The preparation methods, and reaction capabilities of the cyanate esters are reviewed. Other topics discussed include: (1) preparation and properties of high polymers from multifunctional aromatic cyanate esters, (2) production of glass-fiber-reinforced plastics from multifunctional cyanate esters, (3) molded laminates from cyanates, (4) temperature dependence of the physical properties, and (5) suitability for printed circuits. F.O.S.

N71-16546*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

THERMOCHEMISTRY OF CESIUM-OXYGEN SOLUTIONS AND THEIR GASEOUS ATMOSPHERES, ESTIMATED FROM A PHASE DIAGRAM

Leonard K. Tower Washington Feb. 1971 28 p refs
(NASA-TM-X-2157; E-5781) Avail: NTIS CSCL 07D

The composition of vapor above Cs-Cs2O solutions was computed from a phase diagram using an analytical method devised for binary metallic solutions. While the results should be of interest in the testing of thermionic diodes with partially oxygenated cesium reservoirs, the analytical method may also be useful in extracting thermodynamic information from other phase diagrams in which solutions and compounds are in contact. Author

N71-16625# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

PACIFIC NORTHWEST LABORATORY MANUAL OF PROCEDURES FOR THE ANALYSIS OF METALLIC SODIUM

R. F. Keough, ed. Jun. 1970 78 p refs Sponsored in part by AEC Revised
(BNWL-MA-76-Rev-2) Avail: NTIS

Methods used for the chemical analysis of essentially nonradioactive Na by the Systems Chemistry Section at Pacific Northwest Laboratory are described. The manual is to serve as a laboratory manual, and also to provide a source of background information about the procedures to the chemically oriented scientists and engineers who submit samples. Improvements in the analytical chemistry of Na are being made continually and the methods included in this manual are undergoing evolutionary changes. Major revisions of some sections will be made as better methods become available or as procedures for additional impurities are developed. NSA

N71-16626# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Chemistry.

DEVELOPMENTS OF ROOM TEMPERATURE POLYMERIC SUPERCONDUCTORS Final Technical Report, Jan.–Dec. 1969

Murray Goodman, Yukio Masyda, and Kai C. Su Jul. 1970 33 p refs
(Contract DAAK02-69-C-0272)
(AD-714139; PIB-CM70002) Avail: NTIS CSCL 7/3

The authors have reviewed the basic theories of superconductivity and have evaluated Littles proposed organic superconducting polyene from a synthetic and technical point of view. In addition, they have discussed the conductivity of charge transfer type polymers and conformational effects on conductivity. Various biopolymers and vinyl polymers were synthesized with side chains capable of forming charge transfer complexes. A 1-nylon type intramolecule was developed as a charge transfer copolymer. Author (GRA)

N71-16688*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

POLYMER RESEARCH

In its Space Programs Sum. No. 37-65, Vol. 3, Aug.–Sep. 1970 31 Oct. 1970 p 168–178 refs (See N71-16671 08-30)
Copyright. Avail: NTIS CSCL 07D

Progress in polymer research is reported, including evaluation of spacecraft magnetic recording tapes and magnetic heads, investigation of sterilizable battery separators, and structural analysis of a solid propellant motor under axisymmetric thermal and pressure loading. R.B.

N71-16711# Mound Lab., Miamisburg, Ohio.

EFFECT OF HYDROLYSIS ON THE DISPROPORTIONATION OF TETRAVALENT AND PENTAVALENT PLUTONIUM IONS

G. L. Silver 30 Oct. 1970 31 p refs
(Contract AT-33-1-GEN-53)
(MLM-1743) Avail: NTIS

The concept that equations representing plutonium disproportionation reactions should include three plutonium species as products is expanded to include hydrolysis and complexation.

The utility of variable disproportionation stoichiometry coefficients is discussed, and the presence of maxima in the concentrations of Pu(III) and Pu(VI) which are derived via disproportionation is suggested. The appropriateness of earlier studies of the disproportionation of Pu(IV) which neglected the presence of pentavalent plutonium is questioned. Author (NSA)

N71-16712# Iowa State Univ. of Science and Technology, Ames.
BIBLIOGRAPHY OF MASS SPECTROSCOPY LITERATURE FOR THE LAST HALF OF 1968 COMPILED BY A COMPUTER METHOD
J. Capellen, H. J. Svec, J. R. Jordan, and R. Sun, comps. Nov. 1970 531 p refs
(Contract W-7405-eng-82)
(IS-2327) Avail: NTIS

The last half of 1968 is covered and 5299 articles of interest to mass spectroscopists are listed. There are three sections: a bibliography section, an author index section, and a key word out of context index (KWOC Index) section. The bibliography section lists the authors, the title, and the source for each article. The author index lists the authors' names and the reference numbers of their articles. The KWOC Index lists the key words, the reference numbers of the articles in which the key word appears, and the first 100 characters of the title. Author (NSA)

N71-16721# California Univ., Berkeley. Lawrence Radiation Lab.
ELECTROCHROMATOGRAPHIC SEPARATIONS OF RARE EARTHS
Louie Nady (Ph.D. Thesis) and Theodore R. Vermeulen May 1970 171 p refs
(Contract W-7405-eng-48)
(UCRL-19526) Avail: NTIS

Electrochromatography was investigated as a possible separation process for ions, particularly for lanthanides and actinides Following a review of previous work, two new advances were developed. One is a proposed device in which a stable broad-band concentration gradient is developed by applying a d-c voltage to a packed bed of ion-exchange resin confined by ion-exchange membranes. The resulting separation depends on solution-phase and resin-phase mobilities of the ions and on the resin selectivity for the ions. Because resin-phase mobilities play an important part, bed conductivity measurements were made for Dowex 50 W-X4 resin in equilibrium with solutions of NaCl, AgNO3, La(NO3)3, Ce(NO3)3, Nd(NO3)3, Ho(NO3)3, and mixtures of AgNO3 La(NO3)3, and AgNO3 Ce(NO3)3. Particle conductivities were then calculated by use of Bruggeman's equation. Electrolyte sorption for these same ions into Dowex 50W-X4, and of La(ClO4)3 into Dowex 50W-X2, X4, X8, and X12 was investigated. The resulting identification of all species in the resin phase made it possible to determine resin-phase mobilities for the individual ions. Author (NSA)

N71-16791# Iowa State Univ. of Science and Technology, Ames.
MOLECULAR ABSORPTION AND LIGHT SCATTERING IN FLAMES EMPLOYED FOR ATOMIC ABSORPTION SPECTROSCOPY
John Angelo Fiorino (Ph.D. Thesis) Aug. 1970 179 p refs
(Contract W-7405-eng-82)
(IS-T-335) Avail: NTIS

Spurious light attenuations encountered in analytical atomic absorption spectroscopy were investigated using premixed, laminar flow, open flames of hydrogen or acetylene supported by air, nitrous oxide or oxygen. Absorption spectra of O2, NO, OH, NH, CN, C3 and C2 were recorded over the spectral region 2000 to 8150 A. The absorption below 2800 A was strongly dependent on mixture strength and flame position. In most of the flames studied, flame absorption continua were identified as the major causes of this light loss. Scattering by salt particles and background flame absorption together accounted for a significant attenuation of the incident radiation. Author (NSA)

N71-16792# Tennessee Univ., Knoxville. Dept. of Chemistry.
RESEARCH CONCERNING IONIC AND FREE RADICAL REACTIONS IN RADIATION CHEMISTRY Progress Report, 15 Sep. 1969 15 Sep. 1970
T. F. Francon 15 Sep. 1970 14 p refs
(Contract AT(40-1)-2968)
(ORO-2968-56) Avail: NTIS

Structure of the electron-excess centers formed by gamma-irradiation in the two crystalline phases of acetonitrile was completely characterized by ESR studies on single crystals. The kinetics of decay of methyl radicals formed by photobleaching the electron-excess dimer centers in CH3CN and CD3CN at 77 K was studied. Radicals formed during the gamma-irradiation at 77 K of trimethyl phosphate, dimethyl methylphosphonate, dimethyl phosphite, trimethyl phosphite, and phosphorus oxychloride were studied by ESR. Kinetics of gamma-radioinduced polymerization of 2-vinyl pyridine was studied. NSA

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N71-15719# Technical Univ. of Denmark, Lyngby. Lab. of Electromagnetic Theory.
THE ANTENNA ADMITTANCE PROBLEM
R. A. Hurd (Ph.D. Thesis) Jun. 1970 215 p refs
Avail: NTIS

The following aspects of the antenna admittance problem are discussed: (1) development of the Wiener-Hopf technique combined with asymptotic methods for dealing with long antennas of the coaxial type, (2) analysis of the input region where the feeder is attached to the antenna, (3) theories for thick antennas, (4) antennas in anisotropic and inhomogeneous media. The antennas considered are the noncentrally-fed dipole, and two kinds of sleeve monopole. ESRO

N71-15737# Technical Univ. of Denmark, Lyngby. Lab. of Electromagnetic Theory.
BACK-SCATTERING CROSS SECTIONS OF SPHERES FOR CALIBRATING PURPOSES IN SCATTERING MEASUREMENTS
J. Appel-Hansen and O. Maersk-Moeller Jul. 1970 36 p refs
(R-79) Avail: NTIS

The available tables of the normalized back-scattering cross sections of perfectly conducting spheres as functions of frequency, required for calibrating radar sets, were extended and the computer output is presented in the form of graphs, and in tables accurate to seven significant figures. ESRO

N71-15776*# Scientific Translation Service, Santa Barbara, Calif.
CHANGES AND IMPROVEMENTS IN THE CONSTRUCTION OF LARGE CASSEGRAIN ANTENNAE WITH PARABOLIC HORNREFLECTOR FEEDS [AENDERUNGS- UND VERBESSERUNGSMOGLICHKEITEN IM AUFBAU GROSSER CASSEGRAINANTENNEN MIT HORNPARABOLSPEISUNG]

G. v. Trentini et al 1 Sep. 1970 21 p refs Transl. into ENGLISH from Frequenz (West Berlin), v. 22, no. 8, 1968 p 216-223 Prepared for JPL
(Contract NAS7-100)
(NASA-CR-113569) Avail: NTIS CSCL 09E

The superposition of the TE(11) and TM(11) circular waveguide modes with the appropriate relative amplitude and phase in the aperture of a horn reflector antenna causes beamwidth equalization and sidelobe suppression of from 17 db to more than 30 db in the electric plane. The TM(11) mode is set up at the junction of two circular waveguides of different cross section. A theoretical analysis of the mode conversion and the dimension of the cross sectional discontinuity for the condition of a rotational symmetric distribution of the radiation field are presented. In addition, measurements of the far field radiation pattern and the near field distribution of the amplitude and the phase are given. The radiation characteristics of the TM(01) and TE(01) circular waveguide modes required for antennas tracking purposes are also investigated. Author

N71-15907* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DUAL MODE HORN ANTENNA Patent
Philip D. Potter, inventor (to NASA) Issued 21 Feb. 1967 (Filed 12 Aug. 1963) 6 p Cl. 343-786 Sponsored by NASA
(NASA-Case-XNP-01057; US-Patent-3,305,870;
US-Patent-Appl-SN-301683) Avail: US Patent Office CSCL 09E

A horn antenna is described for producing and radiating a beam of electromagnetic wave energy containing multiple modes. A radiation pattern of equal beamwidths in the E and H planes, with greatly suppressed sidelobes, is provided. Electromagnetic wave energy in the dominant mode is transferred from a circular waveguide to a cylindrical transition section where a portion of the energy is converted into energy of a higher mode. Energy in both modes then propagates from the transition section into the conical antenna and from there into free space. R.B.

N71-16051# Lehigh Univ. Bethlehem, Pa. Dept. of Electrical Engineering.
CLUSTERING IN DISCRETE STOCHASTIC PROCESSES WITH APPLICATION TO CHANNELS HAVING MEMORY Final Report
Jean-Pierre A. Adoul, Bruce D. Fritchman, and Laveen N. Kanal Aug. 1970 267 p refs
(Grant AF-AFOSR-1390-68)
(AD-714824; AFOSR-70-2559TR) Avail: NTIS CSCL 9/4

The study investigates the disorder properties of random sequences for applications in transmission-channel characterization, coding and data compression. The material is presented in two parts. The first one begins with a systematic introduction to the problem of memory in binary discrete-time stochastic processes. The second part develops the study of statistics for real channel error sequences that are the most useful in implementing present transmission schemes. Author (GRA)

N71-16084# School of Aerospace Medicine, Brooks AFB, Tex.
BIOLOGICAL PRINCIPLES IN RADIOELECTRONICS
Yu. L. Khotuntsev et al [1970] 33 p refs Transl. into ENGLISH of the booklet 'Biologicheskie Prinstipy v Radioelektronike' Moscow Izd-Vo. Znanie, 1967
(AD-714411; SAM-TT-R-972-1170) Avail: NTIS CSCL 6/4

The report covers areas of Powerful radio signal generation techniques; Highly sensitive solid-state receivers; Information theory and methods of obtaining radio information; New operating principles for space scanning systems; The use of computers in radio systems; Successes of microelectronics; Radioelectronics and bionics; Living locators; Sensory systems; Remarksble properties of the cochlea; Image filtering; An electronic model of the Frogs retina; and Neuroelectronic systems and machines with conditioned reflexes. GRA

N71-16088* National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
SERRODYNE FREQUENCY CONVERTER RE-ENTRANT AMPLIFIER SYSTEM Patent
Walter K. Allen, inventor (to NASA) Issued 4 Oct. 1966 (Filed 17 Dec. 1963) 8 p Cl. 325-4
(NASA-Case-XGS-01022; US-Patent-3,277,373;
US-Patent-Appl-SN-331323) Avail: US Patent Office CSCL 17B

A traveling wave tube reentrant amplifier is described which amplifies a microwave signal applied to it and shifts the frequency. Serrodyning is defined as single sideband, suppressed carrier modulation in which the sideband is determined by the adjustment of the amplitude and frequency of the sawtooth deviation signal. The amplifier requires fewer filters and no separate RF mixers, resulting in lower signal losses. R.B.

N71-16119# Army Foreign Science and Technology Center, Washington, D.C.
THE USE OF A WIDEBAND PHOTORECORDING INSTRUMENT TO STUDY PULSE DISTORTIONS
I. F. Ogorodnoychuk et al 1 Sep. 1970 10 p refs Transl. into ENGLISH from Prib. Sist. Avtomat. (USSR), no. 6, 1967 p 62-65
(AD-713922; FSTC-HT-23-330-70) Avail: NTIS CSCL 9/6

The operating range in wire communications channels used to transmit telemechanical information is limited by the higher frequencies. This makes it possible to select that frequency range in which information transmission conditions are optimum: minimum attenuation, linearity of amplitude and phase-frequency characteristics, and minimum distortion level present in the given communications channel. Using existing methods, the nature and distribution of distortions in the accepted operating frequency range were studied with measuring instruments having a selective range of 50-100-1000 hertz. Selected measurements were made at different frequencies with the results registered by indicating instruments or by oscillogram recording in photographic film. Oscillograph recording of distortions in a broad frequency range significantly covering the possible band of the communications channel used, with an appropriate oscillogram processing, provides a full picture of distortion nature and distribution through the entire possible frequency. Author (GRA)

N71-16156*# Kansas Univ., Lawrence. Dept. of Geography and Center for Research in Engineering Science.
RADAR AS A SENSOR IN AGRICULTURE
D. S. Simonett *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 2 1968 28 p refs (See N71-16147 06-13)
Avail: NTIS CSCL 17I

The only radar frequency for which acceptable data have been obtained to date in the Earth Resources Program is K-band. Using these data, the effect of crop type, cover, moisture, and other parameters on radar return of the Garden City, Kansas, test site has been evaluated. Results of the tests indicate: (1) Statistical analysis shows that the type of crop is the most important variable influencing radar return. (2) Major influences on radar return are crop height, percent of ground covered by vegetation, and row height. (3) Crop moisture requires further study. (4) Soil moisture, even for bare ground, shows small influence on radar return during a single month. (5) Some crops depolarize an incident-polarized beam to a different degree than others. (6) Electronic color combining of multiple polarization imagery will aid in crop discrimination. A.L.

N71-16164*# Kansas Univ., Lawrence. Center for Research in Engineering Science.

RADAR PROGRESS IN THE NASA EARTH RESOURCES AIRCRAFT PROGRAM

R. K. Moore *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 2 1968 51 p refs (See N71-16147 06-13)

Avail: NTIS CSCL 17H

Progress made in the application of radar to the Earth Resources Aircraft Program is reviewed. The radar systems used on the NASA aircraft, radar scatterometer and imaging radar, are described and discussed. A.L.

N71-16226# Advisory Group for Aerospace Research and Development, Paris (France).

APPLICATION OF PROPAGATION DATA TO VHF SATELLITE COMMUNICATION AND NAVIGATION SYSTEMS Material Assembled to Support a Lecture Series

Nov. 1970 176 p refs Lectures Presented in Eindhoven, Neth. and Ottawa, Jun. - Jul. 1970; sponsored by AGARD Electromagnetic Wave Propagation Panel and the Consultant and Exchange Programme

(AGARD-LS-41) Avail: NTIS

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3. THE FORMATION OF IONOSPHERIC IRREGULARITIES P. A. Forsyth (Western Ontario Univ.) 6 p refs (See N71-16229 06-13)

4. AMPLITUDE, PHASE AND ANGLE-OF-ARRIVAL FLUCTUATIONS P. A. Forsyth (Western Onterio Univ.) 7 p refs (See N71-16230 06-07)

5. LOW ANGLE FLUCTUATION G. Hartmann (Max-Planck-Inst. fuer Aeronomie, Lindau ueber Northeim, W.Ger.) 12 p refs (See N71-16231 06-07)

6. WORLD WIDE MORPHOLOGY OF SCINTILLATIONS J. Aarons, H. E. Whitney, and R. S. Allen (AFCRL, Bedford, Mass.) 23 p refs (See N71-16232 06-07)

7. MEASUREMENT OF TOTAL ELECTRON CONTENT L. Kersley (Univ. Coll. of Wales) 9 p refs (See N71-16233 06-13)

8. EFFECTS OF HORIZONTAL GRADIENTS AND FURTHER CONSIDERATIONS OF TOTAL ELECTRON CONTENT MEASUREMENTS L. Kersley (Univ. Coll. of Wales) 7 p refs (See N71-16234 06-13)

9. WORLD WIDE MORPHOLOGY OF TOTAL ELECTRON CONTENT J. A. Klobuchar (AFCRL, Bedford, Mass.) 21 p refs (See N71-16235 06-07)

10. IONOSPHERIC MULTIPATH M. D. Grossi (Raytheon Co., Burlington, Mass.) 31 p refs (See N71-16236 06-07)

11. GUIDED PROPAGATION OF RADIO WAVES IN THE IONOSPHERE M. D. Grossi (Raytheon Co., Burlington, Mass.) 24 p refs (See N71-16237 06-07)

12. EXPERIMENTAL RESULTS P. F. Checcacci (Florence Univ.) 4 p refs (See N71-16238 06-07)

N71-16227# Air Force Cambridge Research Labs., Bedford, Mass.

INTRODUCTION TO VHF SATELLITE NAVIGATION AND COMMUNICATIONS SYSTEMS

John A. Klobuchar *In* AGARD Appl. of Propagation Data to VHF Satellite Commun. and Navigation Systems Nov. 1970 4 p refs (See N71-16226 06-07)

Avail: NTIS

Proposed VHF satellite navigation and communications systems are briefly described. In addition, results of tests carried out at VHF, using the NASA Applications Technology Satellites are mentioned. Author

N71-16228# Air Force Cambridge Research Labs., Bedford, Mass.

IONOSPHERIC LIMITATIONS ON PERFORMANCE ON VHF NAVIGATION AND COMMUNICATION SATELLITE SYSTEMS

Jules Aarons *In* AGARD Appl. of Propagation Data to VHF Satellite Commun. and Navigation Systems Nov. 1970 10 p refs (See N71-16226 06-07)

Avail: NTIS

Effects on radio signals traversing the atmosphere are summarized. They include absorption, simple refraction, scintillation, group and phase path delay and Farraday rotation. Absorption, refraction and scintillation have both lower and upper atmosphere components. At low angles of elevation, the lower atmosphere attenuates the signal to a minor extent, refracts it downward, and produces considerable amplitude fluctuation. At higher elevation angles, the ionosphere is the major contributor to atmospheric problems for VHF-UHF satellite beacon transmissions. Author

N71-16230# Western Ontario Univ., London. Centre for Radio Science.

AMPLITUDE, PHASE AND ANGLE-OF-ARRIVAL FLUCTUATIONS

P. A. Forsyth *In* AGARD Appl. of Propagation Data to VHF Satellite Commun. and Navigation Systems Nov. 1970 7 p refs (See N71-16226 06-07)

Avail: NTIS

Propagation of electromagnetic waves through an inhomogeneous ionosphere usually results in variations in the amplitude, phase, and angle-of-arrival of the waves as received at the ground. These variations are known collectively as scintillations. These scintillations are discussed mainly from the point of view of ray optics. This approach gives insight of ionospheric gradients. Author

N71-16231# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Abteilung Weltraumphysik.

LOW ANGLE FLUCTUATION

Gerd Hartmann *In* AGARD Appl. of Propagation Data to VHF Satellite Commun. and Navigation Systems Nov. 1970 12 p refs Supported by the Ger. Min. of Sci. Res. (See N70-16226 06-07)

Avail: NTIS

Radio signal amplitudes from the beacon satellite Explorer 22 were recorded to measure the ionospheric electron content from the Faraday and differential Doppler effects. Frequently these effects were distorted or obscured by other effects. Most of these were due to inhomogeneities in the ionosphere, a few to inhomogeneities in the troposphere. The recordings show two types of ionospheric effects: (1) so-called satellite scintillations, and (2) effects from horizontal gradients in the ionosphere. Satellite scintillations which were observed from 1965 to 1969 are discussed. Author

N71-16232# Air Force Cambridge Research Labs., Bedford, Mass.

WORLD WIDE MORPHOLOGY OF SCINTILLATIONS

Jules Aarons, Herbert E. Whitney, and Richard S. Allen *In* AGARD Appl. of Propagation Data to VHF Satellite Commun. and Navigation Systems Nov. 1970 23 p refs (See N71-16226 06-07)

Avail: NTIS

The irregularity properties of the F layer of the ionosphere

at various latitudes are discussed. In a fine scale theoretical development of scintillation mechanisms the propagation angle relative to the earth's field must be considered. The dominant factors in the morphology of the irregularity structure are geophysical, i.e. the geomagnetic coordinates of the site and the magnetic variations. Author

N71-16235# Air Force Cambridge Research Labs., Bedford, Mass.
WORLD WIDE MORPHOLOGY OF TOTAL ELECTRON CONTENT
John A. Klobuchar *In* AGARD Appl. of Propagation Data to VHF Satellite Commun. and Navigation Systems Nov. 1970 21 p refs (See N71-16226 06-07)
Avail: NTIS

A plot of time delay versus ionospheric total electron content (TEC) is given. It may be that for operational requirements of particular systems, at the times of high TEC values, corrections to ranging systems data will have to be made for the additional ionospheric time delay. The purpose is to give a picture of the world wide behavior of TEC, and to review the data available for time delay predictions on a world wide basis. Results of some data, taken on both sides of the North Atlantic Ocean, are presented to illustrate corrections that can be made with existing data. Author

N71-16236# Raytheon Co., Burlington, Mass.
IONOSPHERIC MULTIPATH
Mario D. Grossi *In* AGARD Appl. of Propagation Data to VHF Satellite Commun. and Navigation Systems Nov. 1970 31 p refs (See N71-16226 06-07)
Avail: NTIS

The characteristics of multipath in ionospheric propagation are discussed. The effects appear as selective fading and intersymbol interference. The analytical approaches used in describing these effects on communication channels make use of static and dynamic models, and combine the description of the multipath with the Doppler spread in the so-called scattering function method. The application of this last method to HF guided propagation paths shows that error probabilities ranging from 0.001 to 0.00001 can be achieved in these ionospheric paths with data rates of 9 kilobits/sec over quasi-antipodal distances, by radiating a few watts at 20 MHz. Author

N71-16237# Raytheon Co., Burlington, Mass.
GUIDED PROPAGATION OF RADIO WAVES IN THE IONOSPHERE
Mario D. Grossi *In* AGARD Appl. of Propagation Data on VHF Satellite Commun. and Navigation Systems Nov. 1970 24 p refs (See N71-16226 06-07)
(Contracts AF 33(615)-1230; F33615-67-C-1917)
Avail: NTIS

Guided propagation of radio waves in the ionosphere includes typically single-wall whispering galleries, double-wall ducts, and slab-supported surface waves. The HF and VHF whispering gallery paths in the lower ionosphere are treated with a Hamiltonian ray tracing approach. The techniques usable in constructing models (fully three-dimensional electron density and electron collision frequency profiles and magnetic field) are outlined and indications are given on how to integrate these models into the Hamiltonian system of equations and start the analytical search for guided propagation paths. Computer programming approaches for the solution of the equations and for the ray plottings are described and computational results illustrated. Full wave treatment is introduced for the analysis of VLF whispering gallery modes in the lower ionosphere. Author

N71-16238# Florence Univ. (Italy). Ist. di Ricerca sulle Onde Elettromagnetiche.
EXPERIMENTAL RESULTS
Pier Francesco Checcacci *In* AGARD Appl. of Propagation Data to VHF Satellite Commun. and Navigation Systems Nov. 1970 4 p refs (See N71-16226 06-07)
Avail: NTIS

Experiments performed using beacons placed on board low orbiting satellites are reviewed. These experiments show the consistent existence of this mode of propagation. Although the lower power and short life of the beacon has up to now precluded the analysis of the mode characteristics and behavior in space and time, it is hoped that in the near future experiments will be conducted to acquire this data. A possible application of this type of research is the use of the mode for communication beyond the line of sight between low orbit spacecraft or from spacecraft to ground. Author

N71-16286# Case Western Reserve Univ., Cleveland, Ohio. Div. of Electrical Sciences and Applied Physics.
A NOTE ON THE FOURIER TRANSFORM OF SCATTERING DIAGRAMS AND SELECTIVE SUMMATION TECHNIQUES
Robert E. Collin Jun. 1970 26 p refs
(Contract F19628-68-C-0088)
(AD-713889; AFCRL-70-0465; SR-3) Avail: NTIS CSCL 20/14

At the present time the most satisfactory theory for propagation in an unbounded homogeneous and isotropic turbulent medium is based on selective summation techniques applied to the Neuman perturbation series for the field. In this theory the various terms in the series may conveniently be represented by graphs or scattering diagrams. In this paper a set of simple rules is presented which permit the required Fourier transform of a given scattering diagram to be obtained very quickly by inspection from the topological structure of the diagram. These rules are established for both the coherent field and its correlation function. In addition a comparison is given of the various theories referred to as Kellers method, renormalization techniques, and approximations commonly employed in obtaining approximate solutions to the exact Dyson equation for the coherent field. It is shown that the Dyson equation, Kellers method, and the renormalization theory all lead to identical results. Author (GRA)

N71-16287# Environmental Science Services Administration, Boulder, Colo. Research Labs.
ON THE CALCULATION OF AN AVERAGE SURFACE IMPEDANCE FOR A PERIODIC SURFACE
Rayner K. Rosich and James R. Wait 18 Sep. 1970 76 p refs
(Contract PRO-Y-70-818)
(AD-714090; ESSA-SR-50; AFCRL-70-0510) Avail: NTIS CSCL 20/14

A point-matching technique is employed to obtain the electromagnetic fields scattered from a surface whose height profile is periodic. The surface impedance or Leontovich boundary condition is assumed to apply in a local sense. Thus the results are restricted to situations where the lower medium is well conducting (e.g., sea water). It is indicated that the convergence of the computational process is very good in the cases tested thus far. Author (GRA)

N71-16288# Environmental Science Services Administration, Boulder, Colo. Research Labs.
ON DIFFRACTION BY A RIPPLED CONVEX SURFACE
James R. Wait 21 Sep. 1970 18 p refs
(Contract PRO-Y-70-818)
(AD-714091; ESSA-SR-51; AFCRL-70-0511) Avail: NTIS CSCL 20/14

A perturbation analysis is employed to obtain a modal equation for diffraction by a perfectly conducting cylindrical surface with a sinusoidal perturbation of the height profile. It is found that the surface impedance concept has a measure of validity in describing the fields averaged over one period of the surface. Author (GRA)

N71-16315# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Electrical Engineering.

SYSTEMS THEORY APPLICABLE TO AIR FORCE COMMUNICATION AND INFORMATION HANDLING PROBLEMS Final Report, 16 Sep. 1965 – 15 Sep. 1970

Jack K. Wolf 15 Sep. 1970 47 p

(Contract AF 49(638)-1600)

(AD-714114; AFOSR-70-2506TR) Avail: NTIS CSCL 9/4

The report summarizes the results of five years of research in the general areas of algebraic systems and stochastic systems. Topics considered related to algebraic systems include: unequal error protection codes, burst and multiple burst correcting codes, codes designed for the Lee metric, improved BCH codes, decoding of BCH codes, system reliability through algebraic coding, channel modeling of real channels, the use of a time dispersive channel as an encoder and the study of certain algebraic sequences. In the study of stochastic systems the following topics were considered: optimum sampling, invariant estimators, feedback communications, adaptive detection and learning, high speed binary data transmission over a-band-limited channel, multiple access communications and rate distortion functions for stochastic sources. Only a brief summary of the research results is presented. However, abstracts of papers and dissertations resulting from this research are included.

Author (GRA)

N71-16418# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

INTERFACE MESSAGE PROCESSORS FOR THE ARPA COMPUTER NETWORK Quarterly Technical Report, 1 Jul. – 30 Sep. 1970

Frank E. Heart Oct. 1970 17 p

(Contract DAHC15-69-C-0179; ARPA Order 1260)

(AD-714234; BBN-2059; QTR-7) Avail: NTIS CSCL 9/2

The basic function of the IMP computer network is to allow large existing time-shared (Host) computers with different system configurations to communicate with each other. Each IMP (Interface Message Processor) computer accepts messages for its Host from other Host computers and transmits messages from its Host to other Hosts. Since there will not always be a direct link between two Hosts that wish to communicate, individual IMPs will, from time to time, perform the function of transferring a message between Hosts that are not directly connected. This then leads to the two basic IMP configurations -- interfacing between Host computers and acting as a message switcher in the IMP network. The message switching is performed as a store and forward operation. Each IMP adapts its message routine to the condition of those portions of the IMP network to which it is connected. An IMP can throw away packets that it has received but not yet acknowledged, transmitting packets to other IMPs at its own discretion. Self-contained network operation is designed to protect and deliver messages from the source Host to the destination IMP.

Author (GRA)

N71-16419# Stanford Univ., Calif. Stanford Electronics Labs.

IRREGULARITIES IN THE QUIET IONOSPHERE AND THEIR EFFECT ON PROPAGATION

Philip A. Fialer Aug. 1970 136 p refs

(Contract Nonr-225(64); ARPA Order 196)

(AD-714203; SU-SEL-70-037; TR-156) Avail: NTIS CSCL 17/2

The primary purpose of this investigation was to determine the nature and characteristics of a class of large, weak ionospheric irregularities which in certain circumstances significantly affect long-distance HF radio-wave propagation. A further purpose was to determine the relative practical importance of the diffraction produced by these inhomogeneities, in relation to the influence of other mechanisms such as Faraday rotation and scattering by small irregularities. Measurements of quasi-periodic variations in phase-path length have been made on a 2600 km one-hop lower-ray F-region path. Variations of 8 to 75 wavelengths are regularly observed during winter daylight hours. A model of the irregularities has been devised and has been used to predict the signal-strength fluctuations which would result from propagation through a medium described by the model.

Author (GRA)

N71-16460# Speech Communications Research Lab., Inc., Santa Barbara, Calif.

ON THE INTERRELATIONSHIPS BETWEEN A WAVE FUNCTION REPRESENTATION AND A FORMAT MODEL OF SPEECH

John D. Markel May 1970 273 p refs

(Contract N00014-67-C-0118)

(AD-714007; SCRL-Monograph-5) Avail: NTIS CSCL 17/2

A detailed study was made of the wave function representation of (voiced) speech developed by G. J. Culler. Four major topics are considered: (1) mathematical preoperties of the Culler formulation, (2) acoustic models of the vocal tract, (3) digital simulation of a particular vocal tract model and of a wave function analyzer/synthesizer, and (4) relations between the parameters of a wave function representation and those of the vocal tract model. Exact time and frequency domain solutions to the Culler formulation are obtained. From these an asymptotic solution of closed form is obtained which leads to a new type of wave function representation, the Gaussian cosine modulation (GCM) formulation. Algorithms are then developed for representing filtered speech using the parameters of the GCM formulation. It is shown that the GCM analyzer behaves essentially identically to the Culler analyzer. Finally, in order to better understand how the wave function parameters relate to the formant parameters, mappings are developed between the wave function parameters and estimates of the formant parameters. It is shown that for either wide or narrow formant separations, reasonably accurate estimations of formant frequencies and bandwidths can be made. It is hoped that the detailed discussion and documentation of the algorithms will assist in an informed evaluation of the appropriateness of the approach for various applied problems in speech processing.

Author (GRA)

N71-16468# Atlantic Research Corp., Alexandria, Va. Jansky and Bailey Engineering Dept.

TROPICAL PROPAGATION RESEARCH, VOLUME 3 Final Report

Richard G. Robertson, John J. Hicks, Charles B. Sykes, and Per A. Anti 1970 133 p refs

(Contract DA-36-039-SC-90889; ARPA Order 371)

(AD-714300) Avail: NTIS CSCL 17/2

The over-all objective of this program is to collect and analyze radio propagation data from actual representative environments needed to advance the state-of-the-art in the design and development of improved radio communication systems in these environments. The report summarizes the results of a series of specialized measurements, using pulse and swept-frequency transmitted signals. Various types of amplitude, frequency, and phase displays were recorded at the test receiver locations. The objective of these measurements was to obtain data which exhibit the multipath characteristics of the jungle path. The report discusses the methods of making these measurements, and the results of a limited analysis of the data. The probability distributions of signal amplitude at VHF in the tropical rain forest test area in Thailand are presented. These distributions are generally a prerequisite to the practical estimation of error rate performance of digital, or wideband, systems in this type of environment. An example is given in which the experimental probability distributions are used to obtain the error rate in an FSK modulation system in this type of environment.

Author (GRA)

N71-16616# Army Foreign Science and Technology Center, Washington, D.C.

RADIO DIRECTION FINDING

V. A. Vartanesyan et al 27 Feb. 1970 234 p refs Transl. into ENGLISH of the book 'Radiopelengatsiya' Moscow, Mil. Publishing House of the Min. of Defense of the USSR, 1966
(AD-714509; FSTC-HT-23-628-70; RA-Q12-68) Avail: NTIS CSCL 17/3

Discussed in the book are the theoretical principles of radio direction finding and the operating principles of the various types of radio direction finders. Questions concerned with the practical use of ground station radio direction finders are reviewed. A great deal of attention is devoted to accuracy in direction finding, and to the sensitivity of direction finding devices in accordance with the conditions under which radio waves are being propagated, the antenna and receiver-indicator system design used, and how the radio direction finders are operated. Author (GRA)

N71-16630# Naval Material Command, Washington, D.C.
HANDBOOK OF ELECTROMAGNETIC PROPAGATION IN CONDUCTING MEDIA
Martin B. Kraichman Jan. 1970 119 p refs
(AD-714006) Avail: NTIS CSCL 20/14

The study of electromagnetic propagation in conducting media has grown considerably in the last two decades and has been accompanied by the usual proliferation of published results in both the open literature and the reports of government and industry. It is therefore desirable as an aid to students and researchers in this field to have available a single source that presents and explains the principal results of these investigations. This handbook is written for the purpose of supplying such an aid. Closed form expressions together with explicit conditions for their validity are presented for the time harmonic electromagnetic fields of plane waves, electric and magnetic dipole sources, finite length electric antennas, and long lines in infinite, semi-infinite, and layered conducting media. Rationalized mks units are used throughout the book. To avoid covering material that is comprehensively covered elsewhere, the present treatment emphasizes those cases in which either the source or the field point or both are in the conducting medium. Ionospheric effects on the electromagnetic propagation are neglected as are also the many applications to geophysical prospecting. Appendices are included on the electrical properties of conducting media, dipole approximation scattering, antenna impedance, and ELF and VLF atmospheric noise. Author (GRA)

N71-16633*# Martin Marietta Corp., Denver, Colo. Electronics Research and Development Dept.
SOME OBSERVATIONS OF CORONA BREAKDOWN ON VARIOUS ANTENNA TYPES IN SIMULATED PLANETARY ATMOSPHERES
C. H. Brockmeyer *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 9 18 refs (See N71-16631 06-09)
Avail: NTIS CSCL 09E

The effects of atmospheric pressure on breakdown phenomena are reviewed, and the corona effect in breakdown in air from 0.073 to 3.5 torr was studied. The breakdown behavior in N, CO2, A, and air mixtures was also determined. The critical breakdown regions on Earth, Mars, and Venus are given, and the requirements imposed by the critical pressure on choice of frequency and antenna design are discussed. Tests of various breakdown characteristics are described briefly. N.E.N.

N71-16634*# Stanford Research Inst., Calif.
VHF BREAKDOWN ON A NIKE-CAJUN ROCKET
J. B. Chown, J. E. Nanevicz, and E. F. Vance *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 19 28 (See N71-16631 06-09)
Avail: NTIS CSCL 09E

The laboratory testing of a VHF quadraloop, Nike-Cajun type antenna is discussed, and results are compared to flight test data. The test procedures, theory, and difficulties in simulating flight conditions are described. The effects of altitude and plasma spreading on breakdown are considered, and two unexpected results are discussed. These are an aerodynamic effect due to the lowering of pressure behind the quadraloop, and the high altitude breakdown due to outgassing effects on multipacting. N.E.N.

N71-16678*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMMUNICATIONS SYSTEMS RESEARCH
In its Space Programs Sum. No. 37-65, Vol. 3, Aug. – Sep. 1970 31 Oct. 1970 p 19 – 44 refs (See N71-16671 06-30)
Copyright. Avail: NTIS CSCL 09C

Research progress is reported on communications systems, including the optimality of the all-digital command system timing loop, Euler products, cyclotomy, and coding in decoding and synchronization, efficiency of biphase-modulated subcarriers and N-channel telemetry systems, optimum performance of two-channel high rate interplex systems, equivalence of time-multiplex and PSK signals for digital communication, standard run-length coding for multilevel sources, and inverting the genetic code in evolution and coding studies. R.B.

N71-16790# Environmental Science Services Administration, Washington, D.C.
FEDERAL PLAN FOR WEATHER RADARS AND REMOTE DISPLAYS: FISCAL YEARS, 1969 1973
Robert M. White Dec. 1969 75 p
Avail: SOD $0.70

This plan is limited to fixed radars and remote displays used for weather surveillance. Mobile radars used for field support of tactical units of the Army, Navy, and Air Force are discussed from the R&D aspects only, since sites are subject to frequent change for military purposes. Established are national requirements for weather radar data based on the combined needs of Federal agencies in the 50 States and Puerto Rico. Developed is an operational concept and presented is a coordinated plan which provides the maximum integration of current and future weather radar facilities consistent with effective and efficient mission accomplishment. Presented are also supporting research and development programs aimed at stated deficiencies in service activities. Author

N71-16794*# Hughes Aircraft Co., Culver City, Calif. Space Systems Div.
PARAMETRIC ANALYSIS OF RF COMMUNICATIONS AND TRACKING SYSTEMS FOR MANNED SPACE STATIONS
Final Report, 5 Jan. 1970 5 Jan. 1971
Dennis Eggert, John Godwin, and Frank Joyce Jan. 1971 209 p refs
(Contract NAS9-10409)
(NASA-CR-114816; SSD-00596R) Avail: NTIS CSCL 17B

The final report on the parametric analysis was divided into two major phases. Phase I provided analyses and assessment of the significant parameters and factors associated with RF communication systems for manned space stations. Phase II used these results in the design of a baseline external communications system for a 12-man space station. Author

N71-16835# Hawaii Univ., Honolulu. Dept. of Electrical Engineering.
THE DESIGN OF SUBOPTIMUM RECEIVERS: AN EXAMPLE
N. T. Gaarder Oct. 1970 23 p refs
(Grant AF-AFOSR-1251-67)
(AD-714599; AFOSR-70-2596TR) Avail: NTIS CSCL 9/4

A Raleigh fading model of a communication channel is used to compare two receivers for a coded, dual diversity, frequency-shift-keyed transmitter. Both receivers are suboptimum; but, unlike the optimum receiver, they can be easily realized. One -- the repetitive receiver -- ignores the diversity and used only the structure of an algebraic code to combat errors. The other -- the diversity receiver -- uses maximal-ratio dual diversity combining and the structure of a less complex algebraic code to reduce errors. Author (GRA)

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N71-15833*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ALLMAT: A TSS/360 FORTRAN 4 SUBROUTINE FOR EIGENVALUES AND EIGENVECTORS OF A GENERAL COMPLEX MATRIX

Gale Fair Washington Jan. 1971 29 p refs

(NASA-TN-D-7032; E-5885) Avail: NTIS CSCL 09B

Subroutine ALLMAT is described and listed. ALLMAT computes the eigenvalues and eigenvectors of a general (non-Hermitian) complex matrix. The program uses the complex QR algorithm to compute eigenvalues and inverse iteration to compute eigenvectors. The user has the option of computing only the eigenvalues, if desired. An entry point EVDATA is available to provide the user with timing and accuracy information, as well as the number of iterations necessary for each eigenvalue and eigenvector. Author

N71-15842*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

POWER SPECTRAL ANALYSIS OF MAGNETIC FIELDS USING A TIME/DATA 100 SYSTEM

James T. Dollens Mar. 1970 21 p

(NASA-TM-X-65413; X-645-70-249) Avail: NTIS CSCL 09B

The use is described of the Time/Data 100, a small digital computer that is specialized in the analysis of time-series data, to analyze magnetic field data. Various aspects considered include: (1) the computer is described with reference to its operation and some of the algorithms employed in its use; (2) the organization of the data is detailed; (3) the results of the analysis of the data are examined; and (4) the Time/Data 100's method is compared with the Blackman-Tukey method of the power spectrum. Author

N71-15908* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

FILE CARD MARKER Patent

Betty Lee S. Phillips, inventor (to NASA) Issued 21 Mar. 1967 (Filed 20 Jul. 1965) 5 p Cl. 129-16.7

(NASA-Case-XLA-02705; US-Patent-3,310,054; US-Patent-Appl-SN-473537) Avail: US Patent Office CSCL 09B

A device is described for flagging punched-type business cards. A single piece file card marker is provided through which the business card may be inserted. The marker is of approximately the same thickness as the business machine card and eliminates the bulky folder. The card can be readily inserted into the marker without mutilation. The marker is secured to the machine card without adhesives or stapling. A tab or raised portion of the marker permits ready identification of a particular card. R.B.

N71-15911*# Maryland Univ., College Park. Computer Science Center.

TREETRAN: A FORTRAN 4 SUBROUTINE PACKAGE FOR MANIPULATION OF ROOTED TREES

John L. Pfaltz Jun. 1970 173 p refs Revised

(Grant NsG-398)

(NASA-CR-116145; TR-65-23-Rev) Avail: NTIS CSCL 09B

TREETRAN, which is a programming system embedded within the FORTRAN language, was written to give the capability of data structure manipulation to the relatively inexperienced programmer. Entire tree structures are treated as if they were ordinary FORTRAN variables, called tree variables, and the programmer needs only eighteen intuitively natural functions and subroutines to work with them. The material presented describes: (1) the characteristics of tree structured data along with related terminology, (2) the naming conventions attendant to the creation of tree variables, (3) all of the tree manipulating operations available in TREETAN, and (4) the application of TREETAN to several different problem areas. In addition, the implications of the concept are discussed and a short reference summary of all TREETAN routines is given. D.L.G.

N71-15965*# TRW Systems Group, Redondo Beach, Calif.

A COMPUTER PROGRAM TO STUDY THE MOTION AND APPENDAGE STRESSES OF A SATELLITE DEPLOYING A NUMBER OF ASYMMETRICAL SEGMENTED APPENDAGES (N-BOOM), USERS MANUAL, VOLUME 1 Final Report

P. B. Grote and I. Tarnove May 1970 186 p ref

(Contracts NAS5-11221; NAS5-11258)

(NASA-CR-116148; TRW-13548-6004-R0-00-Vol-1) Avail: NTIS CSCL 09B

The prediction of the motion for a spinning, accelerating spacecraft and its appendages during deployment maneuvers was studied to estimate segment stresses. External forces and torques considered arise from gravity forces acting on the center of mass of each body in the system, and thrust applied to the main body. The equations of motion are derived and reformulated in a matrix-equation suitable for solution by computer techniques. The loads and stresses required to calculate segment stresses are presented. A description of the computer program, subroutines, flow charts, and program listings are included. F.O.S.

N71-16006*# Maryland Univ., College Park. Computer Science Center.

FORMAL: A FORMULA MANIPULATION LANGUAGE

Charles K. Mesztenyi Sep. 1970 66 p Prepared for JPL

(Contract JPL-952695; Grant NGL-21-002-008)

(NASA-CR-116149; TR-70-133) Avail: NTIS CSCL 09B

The FORMAL system is an extension of FORTRAN 5 which provides the user with the capability of performing symbolic algebraic manipulation. In this system, the value of a variable can be a symbolic algebraic expression. Arithmetic operations, differentiation, special operations, and simplification of symbolic algebraic expressions are all provided by the system. The interactive FORMAL system is a subset of the FORMAL system which is independent of FORTRAN 5. This system can be used for symbolic algebraic manipulation in an interactive environment such as teletype. Author

N71-16096# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

RESULTS OF THE DEVELOPMENT OF A SERIES OF ANALOG-TO-DIGITAL COMPUTERS

N. P. Ermilov et al 4 Sep. 1970 10 p Transl. into ENGLISH from the publ 'Sredstva Analogovoy i Analogo-Tsifrovoy Vychislitelnoy

Tekhniki' Moscow, Izd-Vo. Mashinostr., 1968 p 270-273
(AD-714786; FTD-MT-24-76-70) Avail: NTIS CSCL 9/2

Accuracy and speed characteristics of several analog-to-digital converters are reported. A multichannel voltage-to-number converter operates on the digitwise-encoding principle, uses dynamic triggers, AND and OR gates; it has 10 digits, 12 inputs; conversion time, 80 mu sec per signal per channel; frequency, not over 10 kHz; temperature range, minus 40 plus 60C. A modification of this converter has a 30 percent shorter conversion time. A high-reliability converter operates on the time-encoding principle and uses parallel-redundance circuits; maximum conversion time, 320 mu sec.; 5 digits; mean time to failure, 5000 hours; 1-MHz dynamic inverters are employed. A converter with an automatically controlled slant of its sawtooth voltage is a modification of the preceding type; its block diagram is briefly explained. A high-speed current-to-number converter operates at 10-15 MHz and has 4 binary digits; input signal is applied to all digit amplitude discriminators in parallel (with different delays); a block diagram is shown.
Author (GRA)

N71-16271# Argonne National Lab., Ill.
ARGONNE CODE CENTER: BIBLIOGRAPHIES OF COMPUTER PROGRAM LITERATURE
C. Harrison, Jr. and Marianne Legan Jun. 1970 202 p
(Contract W-31-109-eng-38)
(ANL-7684) Avail: NTIS CSCL 09B

A collection of bibliographies of literature on computer programs developed in the areas of nuclear physics, reactor design, operation and engineering is presented. Each bibliography is divided into three sections. The first is a KWIC (keyword in context) subject index. The second section (green) is a two-column alphabetical listing of author's names. Section three is a listing of the bibliographic items in item accession number order. Asterisks enclose the computer program name in cases where the name is not included in the entry title.
Author (NSA)

N71-16272# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
HRG3: A CODE FOR CALCULATING THE SLOWING DOWN SPECTRUM IN THE P1 OR B1 APPROXIMATION
J. L. Carter Jun. 1970 126 p refs
(Contract AT(45-1)-1830)
(BNWL-1432) Avail: NTIS CSCL 09B

The HRG3 computer program is written in FORTRAN 4 for the UNIVAC 1108 computer system. The program computes the slowing-down spectrum over the energy range 10 MeV to 0.414 eV in either the B sub 1 or P sub 1 approximation, using 68 groups of neutrons with a constant group width of delta u = 0.25. The calculated flux and current spectra are used to reduce the original 68-group cross-section data to average values over as many as 33 broad groups.
Author (NSA)

N71-16316# National Biomedical Research Foundation, Silver Spring, Md.
REALIZATION OF A BILLION-GATE COMPUTER Final Technical Report
Robert S. Ledley Jul. 1970 18 p refs
(Contract Nonr-3265(00))
(AD-714009; NBR-70101/3265) Avail: NTIS CSCL 9/2

The primary objective of work on this contract was to develop methods and techniques for realizing the logical design and analysis of a billion-gate computer. If it were possible to construct a billion-gate computer in an extremely small volume, the problems arise of whether or not these gates can be organized in a fashion that will present substantially increased computing capabilities and also whether or not such an advanced computer can be programed in a feasible manner. Toward this end the report considered problems in five areas as follows: (a) New Capabilities: The report analyzed new capabilities that can be realized through the logical design of a billion-gate computer and methods for their realization. (b) Automatic Design - External: The report investigated problems that arise of how to have a present-day computer automatically generate the final design of a billion-gate computer. (c) Automatic Design - Internal: The report developed methods to give the billion-gate computer the capability for effectively redesigning parts of its internal logical structure; that is, so that a fixed logical design can be made to give the computer the capability to virtually redesign some of its parts. (d) Automatic Reliability - Built-in: On the assumption that no actual part-replacement maintenance can occur, the report developed methods such that gate reliability can be logically designed in. (e) Automatic Reliability - Self-healing: The report developed methods by which the computer can be made to fix itself, in the sense of locating faulty circuits and automatically transferring functions to other properly operating parts of the computer.
Author (GRA)

N71-16334# RAND Corp., Santa Monica, Calif. Computer Sciences Dept.
SOVIET CYBERNETICS REVIEW, VOLUME 4, NO. 8
Wade B. Holland, ed. Sep. 1970 79 p refs
(Contract F44620-67-C-0045; Proj. RAND)
(AD-714068; RM-6200/8-PR) Avail: NTIS CSCL 9/2

Soviet R+D is redirected toward industrial needs. Besides computers and automation, major attention is on power engineering, electronics, nuclear applications, chemistry, earth sciences, economic control, and microbiology. Microorganisms are the reagents in the first large-scale production of protein and from petroleum hydrocarbons. Automatic diagnosis of brain tumors was 85 percent successful by computer, 90 percent by diagnostic table. Computers are little used for accounting. Ukrainian scientific/technical information system includes a fund of over 2500 algorithms, programs, and users guides. Romanian electronic progress is reported. The usual complaints of inefficiency, waste, and delay of automation appear, as do the usual reports of savings. Tbilisi emerges as a major computer design center with the Tbilisi-1 process controller and M-1000, first of the third-generation modular Soviet computers. The BESM-3M read/write head wears out tapes. Other hardware is discussed or pictured.
Author (GRA)

N71-16385# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
NATURAL COMMUNICATION WITH COMPUTERS 3 Final Report, 31 Aug. 1969 - 30 Sep. 1970
Daniel G. Bobrow 30 Sep. 1970 44 p refs
(Contract F19628-70-C-0013; ARPA Order 627)
(AD-714089; BBN-2015; AFCRL-70-0505) Avail: NTIS CSCL 9/2

The objective of the research is to develop techniques to facilitate natural communication with computers, people, other computers, and real-time devices. The work has been carried on as an integrated research program; work on semantic automatic language processing and automatic programming aids was performed and work on the development of time-sharing systems was done. In accordance with a responsibility to report the results of this investigation the authors have prepared a number of documents, some of which have been distributed as scientific reports under the contract, some of which have been published as technical articles in professional journals and a few of which are internal memoranda which the authors have made available to interested outside parties. Following a brief summary of the authors research the authors include abstracts of these documents for further information.
Author (GRA)

N71-16400# New York Univ., N.Y. Dept. of Electrical Engineering.

A SYSTEM FOR SYNTAX SPECIFICATION IN ON-LINE PATTERN RECOGNITION

Onkar P. Sharma Sep. 1970 58 p refs
(Contract N00014-67-A-0467-0010)
(AD-714017; TR-403-13) Avail: NTIS CSCL 6/4

Graphic input-output devices are becoming increasingly popular as the most natural and direct on-line interface between the user and a computer. In order to make direct graphic input possible, it is necessary to have a pattern recognition scheme. As the pattern sets to be recognized are different for different applications, a linguistic approach appears appealing because of its flexibility. An algorithm is presented that builds up an efficient grammar for different classes of pattern sets in a uniform and optimal way. The data structure appropriate for efficient implementation of the algorithm is also suggested. Author (GRA)

N71-16413# Louisiana State Univ., Baton Rouge. Coastal Studies Inst.

OCEANOGRAPHIC OBSERVATIONS OF OIL SLICKS DURING THE CHEVRON SPILL Technical Report, Mar. 1970

Stephen P. Murray, William G. Smith, and Choule J. Sonu 30 Sep. 1970 117 p refs
(Contract N00014-69-A-0211-0003)
(AD-714260; TR-87) Avail: NTIS CSCL 13/2

Oceanographic observations near the Chevron spilling well off the Mississippi Delta in March, 1970, revealed relative roles of various physical factors of the regional estuarine system in the behavior of oil slicks. Surface stress from the wind was most important; at speeds above 15 mph the slick orientation was generally determined by the wind direction. The wind also indirectly affected oil which was sunk by dispersant in that wind waves promoted mixing, which in turn affected the vertical stability, hence eventually the velocity profile. Wind setups and setdowns were correlated with downward and upward isopycnal movements, respectively. Both calculations and observations showed that tidal currents produced an L-shaped slick geometry when winds were below about 15 mph. The diurnal rotation of the tidal currents served to limit the excursion length of oil from the source, keeping it short of the nearest shore. The presence of fresh water from the Mississippi River in the surface layer and the consequent development of convergence lines often formed a natural barrier, preventing oil from encroaching upon the shore. Theoretical analysis using turbulent diffusion theory disclosed that the area and length of a steady-state oil slick increased with oil discharge but decreased with current speed and the lateral diffusion coefficient. Author (GRA)

N71-16431*# Bellcomm, Inc., Washington, D.C.

TIME-SERIES ANALYSIS PACKAGE (TSAP) FOR TERMINAL USE

G. G. Andersen and R. R. Singers 31 Dec. 1970 103 p refs
(Contract NASw-417)
(NASA-CR-116179; TM-70-1031-3) Avail: NTIS CSCL 09B

The time series analysis package (TSAP) is presented in the form of a user's manual, and is a set of eleven interactive, functionally dependent time series programs which are accessible in any order from a remote terminal. TSAP has been designed so that an analyst can conduct a basic portion of the statistical calculations involved in multiple time series analysis during one session at a terminal. This allows the analyst to avoid the waiting times between outputs that occur with standard batch processing. In addition, it takes advantage of the sequential nature of the statistical computations involved in the analysis of time series. . . . Author

N71-16432*# Telpar, Inc., Dallas, Tex.

FAULT ISOLATION AND DIAGNOSTIC TEST TECHNIQUES FOR LARGE SCALE ARRAYS IN SEQUENTIAL DIGITAL NETWORKS Final Technical Report

1970 174 p refs
(Contract NAS12-2201)
(NASA-CR-116199) Avail: NTIS CSCL 09B

The capabilities and usage of the combination test generation program are described. The program attempts to generate tests for any nonredundant fault in a combinational logic net. If the user does not specify a particular set of faults, the program derives the collapsed set of all possible S-A-1 and S-A-O faults. The required extensions to the program for handling faults in RS and JK flip-flops are analyzed in detail. R.B.

N71-16439*# Bellcomm, Inc., Washington, D.C.

MODAL ANALYSIS COMPUTER PROGRAM PACKAGE

D. L Mather 7 Jan. 1971 36 p refs
(Contract NASw-417)
(NASA-CR-116178; TM-71-1015-1) Avail: NTIS CSCL 09B

The fundamental purpose of the modal analysis computer program package is to find some or all of the frequencies lambda (in cps) and some or all of the (orthogonal) mode shapes y of any linear discrete system which is governed by a generalized eigenvalue equation of the form Ky = lambda My, where (1) M and K are real symmetric matrices, (2) M is positive definite, (3) M is not ill-conditioned with respect to inversion, and (4) M and k are possibly, but not necessarily, large matrices. The given problem is reduced to a real symmetric algebraic eigenproblem Px = lambda x by the method of Cholesky. The real symmetric matrix P is reduced to a real symmetric tridiagonal matrix by the method of Householder. The eigenvalues of the tridiagonal matrix (which are the same as those of the original problem) are found by a Sturm sequence bisection method. The user can have the eigenvectors of the tridiagonal matrix computed by either inverse iteration or a combination of inverse iteration and Gram-Schmidt orthogonalization. The eigenvectors of the tridiagonal matrix are then transformed back into those of P or into those of the original problem. Author

N71-16459*# Virginia Polytechnic Inst., Blacksburg. Dept. of Industrial Engineering.

THE GERT SIMULATION PROGRAMS: GERTS 3, GERTS 3Q, GERTS 3C, AND GERTS 3R

A. Alan B. Pritsker and Roland R. Burgess 1970 95 p refs
(Contract NAS12-2113)
(NASA-CR-116177) Avail: NTIS CSCL 09B

The procedures are described for using a digital computer program for simulating GERT networks. New and advanced GERT concepts are introduced. The simulation program can accommodate GERT networks which have logical operations associated with the input side of a node and branching operations associated with the output side of a node. Logical operations associated with a node are defined in terms of the number of realizations of activities incident to the node that must occur before the node can be realized. A similar quantity is required for realizing the node after its first realization. GERT networks are simulated by a program labeled GERTS 3. GERTS 3 is a fundamental package and as such provides the foundation for building advanced network simulation programs. GERT 3 was extended in three directions. First, a queue node capability was added resulting in the GERTS 3Q program. The cost information was added to obtain GERTS 3C. The third extension involved the inclusion of resource requirements for each activity and limited resources to perform the project. The simulation package to study resource allocation was labeled GERTS 3R. Author

N71-16508*# Bellcomm, Inc., Washington, D.C.

AUPLOT 2: A SYSTEM OF DATA HANDLING AND PLOT INSTRUCTION SUBROUTINES FOR COMPUTER GRAPHICS

R. F. Jessup 20 Nov. 1970 34 p refs
(Contract NASw-417)
(NASA-CR-116218; TM-70-2011-2) Avail: NTIS CSCL 09B

AUPLOT 2 which is defined as a set of Fortran callable subroutines designed to facilitate computer plotting in scientific and simulation applications is presented. It is an implementation of logical and step-by-step data collection and plotting procedures which are largely independent of specific computer and plotting devices. AUPLOT 2 may be used in either interactive or batch environments. It features deferred plotting from a data and instruction queue which is temporarily stored on a secondary file. Use of the secondary file minimizes space requirements for computer graphics in the AUPLOT user's program. Author

N71-16643# Ohio State Univ., Columbus. ElectroScience Lab.
TOPOLOGICAL MANIPULATION OF LINE DRAWINGS USING A PATTERN DESCRIPTION LANGUAGE
Kenneth J. Breeding and John O. Amoss Aug. 1970 39 p refs
(Grant AF-AFOSR-1710-69)
(AD-714593; AFOSR-70-2585TR; TR-2768-3) Avail: NTIS CSCL 9/2

A large proportion of the pictures dealt with in computer graphics are line drawings. In the process of displaying these drawings certain topological manipulations such as rotations, reflections and scaling may be desired. The paper describes how such manipulations may be carried out by transformations on strings describing the pictures. The string language used is a pattern description language called PADEL. Pictures in two and three dimensional space are considered. The transformations described for two dimensional pictures are rotations, reflections about an arbitrary axis, and uniform scale changes. A nonuniform scale change consisting of scaling along an arbitrary line is also described. Such scaling may be termed rubber sheet warping. The pattern description language is next extended to three dimensional objects by representing the branch labels as three tuples the element of which are the branch direction cosines. Rotations of the pictures about the coordinate axis are then described. It is then shown that the angular relationships among the branches of the picture remain invariant under this rotation. An inverse rotation is then introduced. Projections of the picture onto the principle planes are next described followed finally by projections onto arbitrary planes.
Author (GRA)

N71-16672*# Little (Arthur D.), Inc., Cambridge, Mass.
A STUDY OF MASS MEMORY APPLICATIONS
David A. Curtis Aug. 1970 119 p refs
(Contract NAS5-21531)
(NASA-CR-116242) Avail: NTIS CSCL 09B

An extensive and detailed review of mass memory storage technologies has been made. Detailed information on the present status of the technologies listed below was obtained from the literature and from technical discussions with leading workers in the various technologies. This information was analyzed to give (1) predictions of the status of mass memory technologies by 1975, and (2) to recommend a technology to replace tape recorders in spaceborne applications. Author

N71-16675*# Raytheon Co., Sudbury, Mass. Equipment Div.
DESIGN AND DEVELOPMENT STUDY FOR A SPACE BASE DIGITAL COMMAND SYSTEM Final Report, 1 Jan. - 31 Dec. 1970
J. J. Stiffler and R. Adams 27 Dec. 1970 357 p ref
(Contract NAS-10419)
(NASA-CR-114817; ER71-4005) Avail: NTIS CSCL 09B

The results are presented of a design and development study for a space base digital command system. The purpose of the command system is to serve as the primary control link between ground stations and a space base and between the space base and its associated satellites. The system must be capable of accepting messages from the ground and relaying them either to a specified location within the space base or to the appropriate subsidiary satellite. It must also be able to accept messages originating on the base and to multiplex them in order of priority with those emanating from the ground for transmission to the associated satellites. In addition, since the command system is to be spaceborne, power/consumption, weight, and volume are all critical parameters and must be kept to a minimum consistent with the system objectives. This is particularly true of that portion of the system which is to be included in each of the subsidiary satellites. Author

N71-16674*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FLIGHT OPERATIONS AND DSN PROGRAMMING
In its Space Programs Sum. No. 37-65, Vol. 3, Aug. - Sep. 1970 31 Oct. 1970 p 12-15 refs (See N71-16671 06-30)
Copyright. Avail: NTIS CSCL 09B

The Flight Path Design Program (FPDP) is described for generating a data base of transit trajectories for 1971 Mars and 1972 Jupiter missions and for displaying requested contours. FPDP also uses the Space Research Conic Program to calculate single leg trajectories which vary launch and arrival dates. The General Plot Program is used to provide a graphical output capability, and provides contour plotting. R.B.

N71-16675*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SCIENCE DATA ANALYSIS
In its Space Programs Sum. No. 37-65, Vol. 3, Aug. - Sep. 1970 31 Oct. 1970 p 16-18 (See N71-16671 06-30)
Copyright. Avail: NTIS CSCL 09B

The image processing laboratory processes video information with a digital computer to enhance the video data. The time necessary to yield the end process can be greatly reduced if the operator can view the intermediate processes while the job is being run on the computer. The described computer refreshed display is a device which displays a 256 × 256 pixel raster with each pixel being modulated to any one of 16 possible intensities. The raster is interlaced, with alternate lines being displayed on successive fields. The repetition rate is approximately 14 frames/s, which is equivalent to approximately 28 field/s. Author

N71-16684*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACECRAFT DATA SYSTEMS
In its Space Programs Sum. No. 37-65, Vol. 3, Aug. - Sep. 1970 31 Oct. 1970 p 148-155 refs (See N71-16671 06-30)
Copyright. Avail: NTIS CSCL 09B

Research progress is reported on application of nonadaptive transversal filters to playback of digital tape recorder signals and hardening techniques for a complementary-symmetry MOSFET memory for outer planet spacecraft. R.B.

N71-16826# Illinois Univ., Urbana. Dept. of Computer Sciences.
[COMPUTER PROGRAMMING AND HARDWARE DEVELOPMENT] Quarterly Technical Progress Report, Apr. - Jun. 1970
Jun. 1970 213 p Sponsored by AEC
(COO-1018-1214; COO-1469-173) Avail: NTIS

A single TV camera and laser have been able to project large screen video in monochrome with alternate line resolution. In the area of bundle processing there is a report on a bundle signal repeater designed to solve the attrition problem. Also described is the configuration of a stochastic arithmetic bundle machine and the hardware design of Eidolyzer. The APE report deals first with how the addition and subtraction operations are to be performed

and, secondly, with the mechanism of radiative power transfer to the APEs. Finally, modifications to the encoder and thermal biasing scheme of colormatrix are reported. Author (NSA)

N71-16833# Michigan Univ., Ann Arbor.
THE CAMA DATA STRUCTURE
L. J. Julyk and L. W. Wolf Aug. 1970 39 p refs
(Contract DA-49-083-OSA-3050; ARPA Order 716)
(AD-714033; MEMO-29) Avail: NTIS CSCL 9/2

The CAMA Data Structure is a variation on a standard inverted-tree data structure. Data is stored in packs which are blocks of contiguous, dynamically allocated storage. Once a pack has been defined it need not remain in virtual memory. If it is a member of the permanent Data Structure it can be shifted out of virtual memory and stored on disk memory until it is referenced again. If it is a member of a temporary Data Structure it can be destroyed when it is no longer needed. Garbage collection is handled automatically for all predefined types of packs. Author (GRA)

N71-16851# Los Alamos Scientific Lab., N.Mex.
GRADPRO: A COMPUTER PROGRAM FOR USE IN ISOPYCNIC DENSITY GRADIENT CENTRIFUGATION
P. N. Dean, B. J. Noland, and G. R. Shepherd Sep. 1970 10 p refs
(Contract W-7405-eng-36)
(LA-4416) Avail: NTIS

A computer program has been developed for use in solving equations describing the behavior of suitable solvents during cesium chloride isopycnic density gradient centrifugation. Given basic information concerning the geometry and an angular velocity of the centrifugal system and the initial properties of the gradient salt solution, the program will solve for each peak the real mean position r sub o of the solute band, the density and density gradient at position r sub o, and a molecular weight estimate based on bandwidth variance of the solute peak. Author

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N71-15713# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Abteilung Magnetofluiddynamische Energiewandlung.
BEHAVIOR OF SILICON SCHOTTKY BARRIER PHOTODIODES AT LIQUID NITROGEN TEMPERATURES
Richard James Henry Jul. 1970 14 p
(DLR-MITT-70-08) Avail: NTIS; ZLDI Munich: 4,60 DM

The temperature of a silicon photodiode light detector was lowered from 295 to 78 K using liquid nitrogen. The output voltage decreased with decreasing temperature, the maximum loss being 98.9%. Repeated thermal cycling did not damage it or alter its room temperature performance. Author (ESRO)

N71-15935# Ballistic Research Labs., Aberdeen Proving Ground, Md.
MINIATURE TELEMETRY SYSTEMS FOR GUN-LAUNCHED INSTRUMENTATION
William H. Mermagen Aqu. 1970 42 p refs
(AD-713874; BRL-MR-2055) Avail: NTIS CSCL 9/6

Miniature telemetry systems to instrument projectiles and ejection payloads have routinely survived accelerations up to 60,000 g and transmitted data from thermistors, accelerometers, and solar sensors. Subassemblies such as VCOs, commutators, and FM transmitters operating at VHF are described. A meteorological ejection payload to measure temperature in the earths atmosphere is described in detail. The result of an on-board roll rate measurement are presented. The application of tested component subassemblies to the problem of vehicle dynamics instrumentation is discussed. Author (GRA)

N71-15936# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATION OF DIGITAL CURRENT-DISTRIBUTION SYSTEMS ON MICRON TAPE CORES
V. G. Kolosov et al 14 Aug. 1970 15 p refs Transl. into ENGLISH from Tr. Politekhn. Inst. (Leningrad), no. 291, 1968 p 189-194
(AD-714768; FTD-MT-24-73-70) Avail: NTIS CSCL 9/2

The procedure is set forth of calculation of current-distribution circuits with micron -type tape cores which have a relatively narrow square loop and, hence, a low power consumption; they operate within minus 60 plus 50C at clock frequencies up to 500 kHz. Four conditions of operability of a transmiting microcell should be observed: (1) for a reliable priming of load cores C, the conducting branch should satisfy a given condition; (2) the volt-sec capacity of a given winding of the nonconducting core should not be lower than the total v-s capacity of the conducting branch carrying the collector current; (3) the voltage pulse developed by the shaper should produce sufficient collector current; (4) an overvoltage protection should be given to the transistor in the shaper circuit. Function calculation procedure along the above four points is given. Test results of two hookups of micro current-distribution circuits are briefly reported. GRA

N71-16056# Aerospace Corp., El Segundo, Calif. Lab. Operations.
A DIGITIZING ELECTROMETER SYSTEM USING AN INTEGRATING-CIRCUIT PREAMPLIFIER
William T. Chater 1 Oct. 1970 32 p refs
(Contract F04701-70-C-0059)
(AD-714561; TR-0059(6260-10)-4; SAMSO-TR-70-382) Avail: NTIS CSCL 14/2

An electrometer system is described that makes use of a conversion from input current to frequency. The data-handling section employs digital circuit techniques that allow the dynamic range of the system to be adjusted to the requirements of the experiment and that present the output in pulse form compatible with contemporary logic systems. The conversion of the input current variable to frequency is achieved by use of an integrating preamplifier circuit having a capacitive feedback element consisting in part of a reed relay that resets the integrator voltage. Since leakage currents can be controlled in all components of the input circuit, the calibrated current range of the system can be extended down to the order of 10 to the minus 14th power A. Resolution of the system as defined by the inherent noise in the integrator circuit is discussed in an appendix note. Author (GRA)

N71-16086* Space Technology Labs., Inc., Redondo Beach, Calif.
APPARATUS FOR MEASURING ELECTRIC FIELD STRENGTH ON THE SURFACE OF A MODEL VEHICLE
Patent
John M. Sellen, Jr. and David F. Hall, inventors (to NASA) Issued 20 Sep. 1966 (Filed 5 Mar. 1964) 7 p Cl. 73-147 Sponsored by NASA
(NASA-Case-XLE-02038; US-Patent-3,273,388; US-Patent-Appl-SN-349782) Avail: US Patent Office CSCL 09C

A space simulation system is described for measuring the

electric field strength of a spacecraft in a plasma sheath. The system comprises a cylindrical vacuum chamber, a plasma source, a spacecraft model, and a means for measuring electric current. E.C.

N71-16089* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

THREE-AXIS FINGER TIP CONTROLLER FOR SWITCHES Patent

Armando E. Lopez, inventor (to NASA) Issued 6 Sep. 1966 (Filed 18 Feb. 1965) 6 p Cl. 200-6

(NASA-Case-XAC-02405; US-Patent-3,271,532; US-Patent-Appl-SN-433821) Avail: US Patent Office CSCL 09E

A remote control device operated by movement of the finger tips is described for manual control of spacecraft attitude. The controller operates in three axes, each two of which can receive input signals without affecting the third axis. The first control member is engaged by the index finger and is supported for movement in either of two planes. A second control member is located adjacent to the first and is engaged by the thumb and second finger of the operator. The apparatus includes a signaling device responsive to rocking movement of the second control member for transmitting a command to the element to be controlled. R.B.

N71-16091# Unitrode Corp., Watertown, Mass.

GENERAL INFORMATION ON USING UNITRODE p-i-n DIODES IN RF APPLICATIONS

[1970] 8 p

(MW-70-1) Avail: Issuing Activity

The construction of Unitrode diodes is discussed with respect to their low electrical losses, low thermal impedance, high-power capability, and high reliability in adverse environmental effects of temperature, acceleration, shock, and vibration. The features of the diodes examined are the equivalent circuits, forward and reverse bias, switching transients, and power dissipation. The performance characteristics of various p-i-n microwave switching and attenuator diodes are given in tabular form. R.B.

N71-16289# International Business Machines Corp., Owego, N.Y. Federal Systems Div.

RELIABILITY INVESTIGATION OF THERMAL STRESS/FATIGUE FAILURE IN MULTILAYER INTERCONNECTION BOARDS Final Technical Report, Mar. 1969 – May 1970

Harvey C. Hurley, Thomas M. Strong, and Malcolm A. Young Griffiss AFB, N.Y. RADC Oct. 1970 103 p refs

(Contract F30602-69-C-0192)

(AD-714702; RADC-TR-70-192) Avail: NTIS CSCL 9/5

Results are reported on the failure mechanisms of multilayer interconnection boards (MIBs) subjected to long-term temperature-cycling tests. The underlying failure process, consisting of low-cycle copper fatigue and leading to circuit open due to fracture, was found to occur at different rates and in different locations as a function of: (1) MIB design geometry and material parameters; (2) manufacturing process parameters; and (3) temperature cycling test profile values. Of particular interest is the presentation of comparative test results showing that straight-wall PTH (plated-through-hole) construction provides somewhat greater resistance to thermal fatigue than does etched-back PTH construction. Results are also given for comparative tests on early-vintage MIBs fabricated using polyimide materials and fluroborate-copper PTH plating. Author (GRA)

N71-16342# Army Foreign Science and Technology Center, Washington, D.C.

EFFECT OF INTERELEMENT MUTUAL COUPLING ON RADIATION PATTERN OF LINEAR ANTENNA IN ELECTRIC SCANNING

A. A. Piotrovskii 1 Sep. 1970 16 p refs Transl. into ENGLISH from Antenny (USSR), no. 3, 1968 p 39 – 48

(AD-714081; FSTC-HT-23-258-70) Avail: NTIS CSCL 9/5

The antenna pattern has been calculated for an equidistant linear antenna array on the assumption that all elements are equivalent and that the mutual coupling of neighboring elements is small and falls off with increasing difference in element numbers. In this case it can be regarded as the product of the pattern calculated without allowing for mutual coupling, multiplied by the mutual coupling pattern. Author (GRA)

N71-16378*# Litton Industries San Carlos, Calif. Electron Tube Div.

EXPERIMENTAL VERIFICATION OF THE DESIGN OF A HIGH EFFICIENCY LINEAR INJECTED BEAM CROSSED-FIELD AMPLIFIER Final Report

C. L. Jones and R. W. Herriott 5 Aug. 1970 93 p refs

(Contract NAS3-11529)

(NASA-CR-72810) Avail: NTIS CSCL 09E

The design of a long life (greater than 2 years), high efficiency linear injected beam crossed-field amplifier including a ten stage depressed collector is discussed. The cw design is experimentally verified in a low duty demountable amplifier. A collector efficiency in excess of 87 percent and a plate efficiency greater than 65 percent at 5 kw peak output power and 2 GHz are demonstrated along with a 10 percent saturated 3 db bandwidth. Methods other than the depressed collector are evaluated for improving the overall efficiency of the device. These methods include potential limiting, phase focusing and beam prebunching. Potential limiting is shown in the experimental amplifier to be a method leading to significant overall efficiency enhancement if no other collector is used. Author

N71-16415# New Mexico Univ., Albuquerque. Bureau of Engineering Research.

THE SILICON MICRO-HALL DEVICE: DESIGN, FABRICATION, AND APPLICATIONS

Roy A. Colclaser and Harold D. Southward Jul. 1970 205 p refs

(Contract N00014-68-C-0158)

(AD-713999; EE-173(70)ONR-005) Avail: NTIS CSCL 9/1

A family of silicon devices, the micro-Hall devices, are described. These include the diffused, diffused-epitaxial, isolation-diffused-epitaxial, mesa-epitaxial, and silicon-on-sapphire isolation-diffused structures. The design and fabrication of these devices are presented in complete detail. The theory of the Hall effect and its applications to the theory of fast neutron displacement damage to silicon is presented. A quantitative model of radiation damage in the form of spherical intrinsic voids representing the damage clusters is described. Three applications of the isolation-diffused-epitaxial silicon micro-Hall device are discussed. The characteristics of the silicon micro-Hall device as magnetic sensor are presented. This application requires a careful compensation for voltages due to the misalignment of the measuring arms. Author (GRA)

N71-16416# Philco-Ford Corp., Blue Bell, Pa.

RESEARCH AND DEVELOPMENT OF HIGH SPEED PROCESSOR ARRAYS Interim Report, 1 Nov. 1969 – 30 Jul. 1970

Aug. 1970 40 p refs Prepared for Lincoln Lab., MIT

(Contract AT 19(628)-5167)

(AD-714080; ESD-TR-70-319) Avail: NTIS CSCL 9/2

The report describes program progress during the eight-month extension period of a research and development program directed

toward the development of high performance, digital MSI-LSI microcircuits and their application in feasibility studies of high speed data processing systems. The tasks of this report period included the fabrication of a high speed 80-gate array with three levels of metallization and the performance evaluation of a high speed (<1.0 nsec), low power (<15 mW), ECL gate design, for various on-chip gate loading conditions. Both tasks were completed. Also required was the fabrication and delivery of three different, custom, ECL Two-Bit Fast Carry Gated Adder microcircuits (two levels of metallization) for application in a high speed 17 x 17 Array Multiplier. A total of 136 adders are required for the multiplier. The required number of adders were delivered, and the multiplier which was assembled using those adders functioned properly. The time required for the multiplier to perform its function was measured to be 40 nsec, a 10-nsec improvement over the expected time. Author (GRA)

N71-16417# Maxwell Labs., Inc., San Diego, Calif.
OPERATIONAL TESTING FOR THE 5.85 MV, 185 kJ FAST MARX GENERATOR Final Report
2 Oct. 1970 71 p
(Contract DASA-01-68-C-0066)
(AD-714018; MLR-80; DASA-2456) Avail: NTIS CSCL 14/2

A 5.85 MV 185 kJ fast Marx was built and tested. Design, development, construction and initial testing were previously reported. The report covers the continuation and completion of the full scale generator testing. Such testing included the firing of a sufficient number of shots to demonstrate the reliability inherent in an advanced design utilizing components, such as switches and capacitors that have been optimized for these applications and the determination of operating characteristics are: Marx inductance 5.2 micro-H, total series resistance 3.3 ohms, and total erection delay time at full rated voltage, 150 nS. The generator is now being outfitted with a water dielectric, coaxial load and vacuum diode assembly. Author (GRA)

N71-16542# Stanford Univ., Calif. Electronics Labs.
ENHANCING TESTABILITY OF LARGE-SCALE INTEGRATED CIRCUITS VIA TEST POINTS AND ADDITIONAL LOGIC
Michael J. Y. Williams Sep. 1970 73 p refs
(Contract N00014-67-A-0112-0044)
(AD-714511; SU-SEL-70-065; TR-4602-1) Avail: NTIS CSCL 9/5

The work studies methods of using test points in conjunction with additional logic gates to provide an easy means to set or check the state. Among several logic modification schemes, the most useful appears to be one in which a single test point can be used to switch the circuit into a second mode of operation, a test mode. In the test mode the flip-flops are reconnected to form a shift register, so that the state can be easily set or checked; however it is not possible to guarantee correct operation in this mode in the presence of a fault. After an initial state has been set, the circuit can be switched to normal mode for a test, then returned to the test mode so that the final state can be checked. For a synchronous sequential circuit whose state can be easily set or checked, the problem of generating a test to detect a given logical fault reduces to the problem of generating a test for the fault in a purely combinational network of similar complexity. The cost of such circuit modifications was analyzed. Author (GRA)

N71-16544# Avco Corp., Wilmington, Mass. Systems Div.
THE NEAR ELECTRIC FIELD OF A RECTANGULAR APERTURE
Ronald L. Fante 7 Oct. 1970 19 p refs
(Contract F19628-69-C-0121)
(AD-714574; AVSD-0550-70-CR; AFCRL-70-0584; SR-1) Avail: NTIS CSCL 20/14

The near electric fields of a rectangular aperture in an infinite ground plane are calculated and discussed for the case of a cosinusoidal aperture distribution. Author (GRA)

N71-16585*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A NOVEL AXISYMMETRIC, ELECTROSTATIC COLLECTOR FOR LINEAR BEAM MICROWAVE TUBES
Henry G. Kosmahl Washington Feb. 1971 50 p refs
(NASA-TN-D-6093; E-5813) Avail: NTIS CSCL 09E

A novel, electrostatic depressed collector for microwave tubes is analyzed. The boundary-value problems, space-charge effects, and trajectories are treated accurately. The design eliminates most of the deficiencies of older collectors and promises to recover up to 80 percent of the energy of spent beams even in the presence of high axial and radial velocity spread. Author

N71-16588*# Westinghouse Electric Corp., Baltimore, Md. Aerospace Div.
ON BOARD PROCESSOR SYSTEM STUDY Final Report
Dec. 1970 53 p
(Contract NAS5-20134)
(NASA-CR-116239) Avail: NTIS CSCL 09E

A study of the present on board processor (OBP) system in order to improve overall system performance is discussed. The study consists of an evaluation of three areas of endeavor: (1) the selection of a new circuit family, (2) an evaluation of microprogramming, and (3) an evaluation of combining the fixed I/O with the CPU. The circuit investigation evaluated off-the-shelf circuits, large scale integration (LSI) circuits previously developed, and special purpose LSI structures for the advanced on board processor (AOP) system. These various approaches were compared for the circuit technologies which initially appeared applicable to the advanced on board processor (AOP) requirements. Microprogramming was investigated as a means of reducing and systematically organizing the control logic in the CPU. Microprogrammed control was attractive from the standpoint of circuit reduction, improved instruction set flexibility, and improved partitioning feasibility. The application of existing LSI memories as well as memories being developed for the near future was investigated for this approach. Author

N71-16598*# Auburn Univ., Ala. Electrical Engineering Research Lab.
AN EFFICIENT, BROAD-BAND, SWITCHING-MODE AMPLIFIER WITH ISOLATED OUTPUT, PART 2 Annual Report
M. A. Honnell, T. D. Slagh, and W. D. Dunmyer 15 Jun. 1970 71 p refs
(Contract NAS8-11344)
(NASA-CR-102997) Avail: NTIS CSCL 09E

Development of the output power amplifier stage for a pulse-width-modulated amplifier with frequency response from dc to 20 kHz is reviewed. The dc isolation from the load is provided through the use of a ferrite-cored switching-transformer to transfer energy from the power amplifier to the load. The amplifier uses two channels, providing amplification for signals of both polarities using output gating. The amplifier uses a 200 kHz switching frequency which allows for the use of small components and gives the amplifier a broadband response. A breadboard model of the amplifier was constructed and tested. A design example for an amplifier which has an output of 7 volts rms into a 70-ohm load is presented. Author

N71-16629# Avco Corp., Wilmington, Mass. Avco Systems Div.

ELECTROMAGNETIC RADIATION FROM AN INFINITE CYLINDER IMMERSED IN AN INHOMOGENEOUS MEDIUM

Ronald L. Fante 7 Oct. 1970 27 p refs

(Contract F19628-69-C-0121)

(AD-714575; AVSD-0549-70-CR; AFCRL-70-0585; SR-2) Avail: NTIS CSCL 9/1

The problem of electromagnetic radiation from a circumferential aperture on an infinite conducting cylinder immersed in an inhomogenous dielectric or plasma medium is treated by the resolvent Greens function method. For a particular variation of the medium, expressions are obtained for the complete electromagnetic fields and for their values in the Fraunhofer zone. Expressions are also obtained for the fields inside a hollow conducting cylinder loaded with an inhomogeneous dielectric. Author (GRA)

N71-16631*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

PROCEEDINGS OF THE SECOND WORKSHOP ON VOLTAGE BREAKDOWN IN ELECTRONIC EQUIPMENT AT LOW AIR PRESSURE

Earle R. Bunker, Jr., ed. 30 Jun. 1970 210 p refs Conf. held in Pasadena, Calif., 5–7 Mar. 1969; sponsored by JPL

(Contract NAS7-100)

(NASA-CR-116173; JPL-TM-33-447) Avail: NTIS CSCL 09E

Conference papers are presented on corona and multipactor discharges, packaging techniques and materials, and breakdown on specific satellite instruments. For individual titles, see N71-16632 through N71-16654.

N71-16632*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A STUDY OF VOLTAGE BREAKDOWN IN SPACECRAFT SYSTEMS FROM TEST AND FLIGHT EXPERIENCE

J. E. Stern and K. R. Mercy *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 3–8 ref (See N71-16631 06-09)

Avail: NTIS CSCL 09E

Surveys were conducted to provide an understanding of breakdown problems and to determine the major factors contributing to them. The first survey was an in-house effort at GSFC and covered reports from 1961 to early 1968 from GSFC sources, contractor test reports, and proceedings of the first workshop on voltage breakdown. Next, engineers and scientists directly connected with OSO-D, OGO-F, and ISIS-A were contacted for further information. The general classes of breakdown prevention were control of electric fields and elimination of cavities and voids. The following information was disclosed: The frequency of voltage breakdowns has not diminished in the past several years. Design is the area most responsible for breakdown problems. Most breakdowns are dc gas discharges; however, multipactor discharges appear more frequently lately. Major factors affecting gas discharges are outgassing, entrapped gases, insulation, geometry, and circuit arrangements. Methods for overcoming general design problems are listed. N.E.N.

N71-16635*# Little (Arthur D.), Inc., Cambridge, Mass.

DEVELOPMENT OF PACKAGING TECHNIQUES FOR AN AMPLITRON AND POWER SUPPLY

P. Felsenthal, D. Grieco (Raytheon Co., Sudbury, Mass.), and J. Fridman (Raytheon Co., Sudbury, Mass.) *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 29–39 Prepared in cooperation with Raytheon Co., Sudbury, Mass. (See N71-16631 06-09)

Avail: NTIS CSCL 09E

The stages in potting techniques for a dc to dc converter and redundant amplitron system, and electric tests of potting materials and potted tube are discussed. The importance of going into the manufacturing operation and insisting on cleanliness is emphasized. Changing the vapor degreaser solution and exact timing of the pour were among the problems encountered. Two failures in the tubes occurred during testing, and were attributed to a mechanical problem between a wire and some mounting screws and to a void in the potting. Problems associated with dc corona are also described. N.E.N.

N71-16637*# Radio Corp. of America, Princeton, N.J. Astro-Electronics Div.

LOW VOLTAGE BREAKDOWN IN ELECTRONIC EQUIPMENT WHEN EXPOSED TO A PARTIAL-PRESSURE NITROGEN ENVIRONMENT CONTAINING WATER VAPOR

R. F. Sharp, E. L. Meyer, and D. E. Collins *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 49–57 (See N71-16631 06-09)

Avail: NTIS CSCL 09E

Simulated circuit tests and electrode tests for a quantitative evaluation of humidity effects are reported. Two basic circuits were simulated: one with components and wire routing duplicating that of the equipment design, and one which attempted to recreate the effect of a ground plane above a row of bifurcated terminals. The electrode test was designed to eliminate all variables except the composition and pressure of gas. The environments consisted of 100% dry nitrogen, 100% water vapor, and mixtures of dry nitrogen and water vapor. The following conclusions were reached: Voltage breakdown curves in 100% water vapor exhibit the same general shape as the familiar Paschen curve. Voltage breakdown levels in 100% water vapor are significantly higher than those in 100% dry nitrogen. The classical Paschen curve can not be applied to predict critical pressure of breakdown in electronic equipment. Addition of water vapor to nitrogen gas increases the breakdown threshold and the breakdown voltage. N.E.N.

N71-16641*# Transformer Electronics Co., Boulder, Colo.

DESIGN CONSIDERATIONS FOR CORONA-FREE HIGH VOLTAGE TRANSFORMERS

Harold C. Byers *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 91–98 (See N71-16631 06-09)

Avail: NTIS CSCL 09A

Design considerations for toroidal transformers to be used at low pressures or in space are discussed. The requirements are described with regard to core size; core construction, wire insulation, and interlayer insulation; and potting materials. Epoxies were selected for impregnating and potting compounds because of their compatibility with each other and with wire insulations. N.E.N.

N71-16643*# Boeing Co., Seattle, Wash. Aerospace Group.

CORONA EVALUATION OF SPACECRAFT WIRES AND CONNECTORS

W. G. Dunbar *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 109–116 refs (See N71-16631 06-09)

Avail: NTIS CSCL 09E

Corona tests on round wire, flat wire, and connectors are reported. The corona-onset voltage (COV) and the corona-extinction voltage were measured on round wires, and results indicate that the minimum COV of a twisted pair is always greater than that of a spaced pair under the same conditions. The effect of Teflon thickness was also determined. Measurements were made on Teflon-insulated flat conductor cables (FCC). Data showed that the

COV between flat conductors was higher than the COV between round conductors, and that the corona-sensitive pressure was narrower for the flat conductors. Tests of COV were made with a 55-pin mated round connector and with a FCC connector. It is concluded that FCC has a higher COV at minimum pressure-spacings than round wire configurations, and that connectors, breakouts, and terminations continue to provide problems. N.E.N.

N71-16677*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMMUNICATIONS ELEMENTS RESEARCH
In its Space Programs Sum. No. 37-65, Vol. 3, Aug. – Sep. 1970 31 Oct. 1970 p 45 – 57 refs (See N71-16671 06-30)
Copyright. Avail: NTIS CSCL 09E

Communications elements are investigated, including a superconducting magnet for X-band maser RF techniques, RF study of reflector surface materials for spacecraft antennas, and S/X-band high gain antenna feed for thermoelectric outer planet spacecraft. R.B.

N71-16681*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MATERIALS
In its Space Programs Sum. No. 37-65, Vol. 3, Aug. – Sep. 1970 31 Oct. 1970 p 122 – 135 refs (See N71-16671 06-30)
Copyright. Avail: NTIS CSCL 09E

Research progress is reported on mesh materials for deployable antennas, irradiation test results for Mariner Venus-Mercury 1973 solar array components, and the crack propagation threshold for isopropanol and Ti-6Al-4V titanium alloy. R.B.

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N71-15790# Toulouse Univ. (France). Lab. de Genie Electrique.
ELECTRICAL AND THERMAL BEHAVIOR OF BIPOLAR TRANSISTORS AT HIGH CURRENTS AND VOLTAGES: APPLICATION TO SECOND BREAKDOWN PHENOMENON [COMPORTEMENT ELECTRIQUE ET THERMIQUE DES TRANSISTORS BIPOLAIRES AUX FORTS NIVEAUX DE TENSION OU DE COURANT: APPLICATION AU PHENOMENE DE SECOND CLAQUAGE]
Philippe Leturcq (Ph.D. Thesis) 1969 221 p refs In FRENCH
Avail: NTIS

The avalanche mechanism in p-n junctions is discussed. The internal electric state of a planar transistor is analyzed for given polarization conditions and the two-dimensional mechanism induced by the base resistance is analyzed independently of the base current. Focusing mechanisms are discussed in relation to the static and dynamic behavior of the transistor, especially at low frequencies. The internal electric state is analyzed numerically for high polarization currents in both the normal and avalanche regimes. The effects of power dissipation in the component are discussed and results applied to the second breakdown phenomenon. ESRO

N71-15859 Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
SIMPLIFIED METHOD OF HYBRID MICROCIRCUIT FABRICATION
F. R. Muccino. *In its* APL Tech. Dig., Vol. 9, No. 4, Apr. 1970 p 14 – 20 refs (See N71-15857 06-23)
Copyright. Avail: APL, Johns Hopkins Univ., 8621 Georgia Ave., Silver Spring, Md. 20910: $0.50

The process of hybrid construction is based on the use of active and passive components so that no externally bonded connections are required. Standard etched circuit board material is used as the substrate to which all elements are attached by means of solder cream. The active elements are leadless inverted devices, the smallest packaged semiconductors available, and resistors and capacitors are in the form of chips. The fabrication process and the increase in the number of active and passive elements per unit area are discussed. Author

N71-15909* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MULTIPLE CIRCUIT SWITCH APPARATUS WITH IMPROVED PIVOT ACTUATOR STRUCTURE Patent
Jim Scow and James L. Jones, inventors (to NASA) Issued 1 Nov. 1966 (Filed 1 Sep. 1965) 8 p Cl. 200-6
(NASA-Case-XAC-03777; US-Patent-3,283,088; US-Patent-Appl-SN-484489) Avail: US Patent Office CSCL 09E

A switch apparatus is described for switching a group of circuits with relatively little hand or eye movement required by the switch operator. The apparatus is provided with a movable control member with visual and/or tactile sensing to inform the operator of the position of the control member. The system also includes an integrated observation panel so that the operator can tell at a glance the position of the control member and the condition of the one or more circuits operable by the control. R.B.

N71-15910* Space Technology Labs., Inc., Redondo Beach, Calif.
AC LOGIC FLIP-FLOP CIRCUITS Patent
Ted Winkler, inventor (to NASA) Issued 1 Nov. 1966 (Filed 8 Jan. 1964) 6 p Cl. 307-88.5 Sponsored by NASA
(NASA-Case-XGS-00823; US-Patent-3,283,175; US-Patent-Appl-SN-336607) Avail: US Patent Office CSCL 09E

Bistable multivibrator circuits are described which are characterized by high speed and low power dissipation. The flip-flop employs a cascaded emitter-follower and ac logic. R.B.

N71-15950# Technische Hochschule Hannover (West Germany).
THE ANDERSON BRIDGE AS BASIC CIRCUIT FOR DIGITAL RESISTANCE MEASURING BRIDGES WITH ELECTRONIC SELF-ALIGNMENT AT DIRECT CURRENT [DIE ANDERSON-BRUECKE ALS GRUNDSCHALTUNG FUER DIGITALE WIDERSTANDSMESSBRUECKEN MIT ELEKTRONISCHEM SELBSTABGLEICH BEI GLEICHSTROM]
Joachim Siebert (Ph.D. Thesis) 1970 161 p refs In GERMAN
Avail: NTIS

A basic bridge circuit is developed by modifying a Wheatstone circuit and introducing a separate frequency response; this constitutes a bridge circuit of the Anderson type. The added branch circuit is utilized to connect the controllable semiconductor resistor with the modified Wheatstone circuit in such a way that its value is not absorbed in the latter's response. The time modulated semiconductor controls the compensating current that self-adjusts the Wheatstone circuit. Circuit voltage equilibrium is obtained by an additional voltage drop triggered by a compensating current in the same circuit branch in which the measurement object is also placed. A linear connection is thus established between the values of the compensating current and the measurement object at equilibrium. Qualitative data of comparisons between resistance measurement circuits and of Wheatstone and Anderson type circuits are shown in table form. Transl. by G.G.

N71-16030* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
REGENERATIVE BRAKING SYSTEM Patent

Klaus Juergensen, inventor (to NASA) Issued 6 Sep. 1966 (Filed 6 Sep. 1963) 9 p Cl. 318-376
(NASA-Case-XMF-01096; US-Patent-3,271,649; US-Patent-Appl-SN-307270) Avail: US Patent Office CSCL 09C

A direct current electromotive system for the regenerative braking of an electromechanical transducer or electric motor is described. The motor is interconnected with a rechargeable dc power source through an inductive energy storage device. A pair of electronic oscillating switches alternately connect and disconnect the source from the motor. A pair of diodes provide a current path to transfer energy back into the power source during the time the oscillating switches are open. Energy is readily transmitted from the source to the motor and the inductive energy storage device during the driving mode, and in the opposite direction during the regenerative braking mode. N.E.N.

N71-16042* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HIGH EFFICIENCY MULTIVIBRATOR Patent
Robert M. Munoz, inventor (to NASA) Issued 4 Oct. 1966 (Filed 20 Sep. 1963) 7 p Cl. 307-88.5
(NASA-Case-XAC-00942; US-Patent-3,277,314; US-Patent-Appl-SN-310506) Avail: US Patent Office CSCL 09C

An improved semiconductor multivibrator circuit is described which approaches 100% efficiency. In this circuit, transistors of opposite conductivity are connected in series with each other and a load resistance. The load resistance is connected to the collector of the first transistor, and the emitter of the first transistor is connected directly to the emitter of the second transistor. A single network coupling the complementary transistors determines whether this circuit is monostable, bistable or astable. F.O.S.

N71-16057* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
INSERTION LOSS MEASURING APPARATUS HAVING TRANSFORMER MEANS CONNECTED ACROSS A PAIR OF BOLOMETERS Patent
Clifford J. Finnie and Danver Schuster, inventors (to NASA) Issued 4 Oct. 1966 (Filed 6 May 1964) 4 p Cl. 324-57 Sponsored by NASA
(NASA-Case-XNP-01193; US-Patent-3,277,366; US-Patent-Appl-SN-366226) Avail: US Patent Office CSCL 09C

A high impedance alternating current sensing device is connected between the outputs of a pair of bolometers, responsive to the signal power inserted into and derived from the component under test, respectively. The sensing device is a transformer primary coupled to a secondary winding, in turn connected through an amplifier to a sensitivity meter. The bolometer inputs are connected together, and a voltage divider between one bolometer output and the sensing device is adjusted to establish a null current condition. The bolometer inputs are then connected to the input and output of the test component, and the voltage divider is adjusted to establish a null current again. The change in position of the voltage divider tap indicates the insertion loss of the component. N.E.N.

N71-16058* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CONDITION AND CONDITION DURATION INDICATOR Patent
Thomas L. Greenwood, inventor (to NASA) Issued 4 Oct. 1966 (Filed 26 Jun. 1963) 6 p Cl. 340-227
(NASA-Case-XMF-01097; US-Patent-3,277,458; US-Patent-Appl-SN-290873) Avail: US Patent Office CSCL 09C

An electric network is described for monitoring a physical condition, such as temperature, detecting when a critical condition occurs, and indicating when it has existed for a critical period of time. A voltage representing the condition to be monitored and a reference voltage representative of the critical condition are applied to a differential amplifier circuit. The voltages are compared, and an output indicating the difference, if any, is applied to a Schmidt trigger circuit. The trigger output is in the form of an abrupt electrical change whenever the difference output indicates that the input condition voltage has varied critically from the reference voltage. The trigger output initiates a timing circuit which provides a signal when the timing circuit has operated for a predetermined time. N.E.N.

N71-16389# Naval Ship Engineering Center, Philadelphia, Pa.
THE IDENTIFICATION OF A CLASS OF NONLINEAR SYSTEM ELEMENTS FROM LINEAR MEASUREMENTS Final Report
J. R. Garnett 15 Oct. 1970 43 p refs
(AD-714489; NAVSECPHILADIV-C-54) Avail: NTIS CSCL 12/1

A conventional technique for determining the dynamic characteristics of a linear system element is the application of the Frequency Response method or Pulse Test method. These methods are also often applied to nonlinear elements at one or more operating points for the purpose of obtaining a linearized small signal model for each operating point. The Frequency Response method and Pulse Test method are both well understood and frequently used by control systems engineers for obtaining the linear characteristics of a system element. This report describes a method by which the results of either of these methods may be used to extend them to the class of nonlinear system elements which are described by nonlinear differential equations having coefficients which are functions of the dependent variables. The method is described and applied to the nonlinear modeling of a main forced draft blower. Author (GRA)

N71-16467# Iowa Univ., Iowa City. Dept. of Mathematics.
AN INVESTIGATION INTO REDUNDANCY AND TESTABILITY OF COMBINATIONAL LOGIC NETWORKS
Ramaswami Dandapani, Sudhakar M. Reddy, and John P. Robinson Sep. 1970 29 p refs
(Contract N00014-68-A-0500; Proj. Themis)
(AD-714157; THEMIS-UI-TR-32) Avail: NTIS CSCL 9/5

Some results on redundancy and testability of combinational logic networks are given. It is shown that there exist tree networks that are testable relatively easily for redundancy and faults. It is also shown that the multilevel networks proposed not only require less hardware but also fewer tests to detect faults than the equivalent two level networks. Author (GRA)

N71-16639*# Sylvania Electric Products, Inc., Needham, Mass.
A VENTED HIGH VOLTAGE SYSTEM FOR SATELLITE APPLICATIONS
D. Laffert *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 73-76 (See N71-16631 06-09)
Avail: NTIS CSCL 09E

The vented high voltage system, for supplying power to data-gathering photomultiplier tubes on an OAO, is described. The high voltage supplies must be capable of operating at all pressures and all conditions without failure to the supplies or to adjacent components and circuits. Modifications were made to existing techniques and include the following: Current in the power supply is limited electronically. A circuit is included which monitors the current return from the high voltage and detects an arc if it occurs. Adjacent circuitry is protected by containing all high voltage in shielded vented containers. Adjacent circuitry is further protected by adding simple input circuitry, two diodes and a resistor. Components are critically selected. Rugged assembly and mounting techniques were developed. N.E.N.

N71-16642*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HIGH VOLTAGE PACKAGING INVESTIGATIONS IN THE ADVANCED TECHNOLOGY GROUP
Earle R. Bunker, Jr. *In its* Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 99-108 (See N71-16631 06-09)
Avail: NTIS CSCL 09C

Problem areas associated with packaging were investigated and are reported. Various foam samples were placed into a chamber pumped down to a high vacuum, and then tested for breakdown voltage. Data showed that where there is a cavity larger than bubble size, there is an outgassing and the pressure goes to the critical region. A corona detection network, with two Zener diode bridges in series, is described and the advantages are identified. A power supply for frequencies as high as 2500 Hz was developed, using a linear power amplifier to drive a step-up transformer. An automatic equipotential plotter for the rapid determination of equipotentials in a complex high voltage geometrics has the electrode configuration drawn to scale with silver ink on resistance paper. Characteristics of transformer encapsulents are outlined, and bonding problems with Teflon-coated wires are considered. N.E.N.

N71-16645*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DC VOLTAGE BREAKDOWN PROCESSES AND EXTERNAL DETECTION TECHNIQUES
R. E. Heuser *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 123-129 refs (See N71-16631 06-09)
Avail: NTIS CSCL 09C

Breakdown near the surface of a photomultiplier tube under space flight conditions is discussed. It is shown that the breakdown voltage is a function of the product of electrode spacing and pressure. A single probe and a photomultiplier tube were used to detect a voltage breakdown, and the results are discussed. It was determined that at a pressure of 30 mtorr, the photomultiplier tube can detect a discharge current of 10 picoampere and the probe can detect 1 nanoampere. N.E.N.

N71-16646*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TESTING OF HIGH VOLTAGE SPACECRAFT SYSTEMS IN A SIMULATED IONOSPHERIC PLASMA
D. R. Burrowbridge *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 131-138 refs (See N71-16631 06-09)
Avail: NTIS CSCL 09C

The simulation of the ionosphere, and the interaction between the charged particles in the ionosphere and the spacecraft system's high electric fields are discussed. The simulated ionospheric characteristics are given, and results of experiments for OSO and OAO are described. It is felt that interactions between electrical systems and ionospheric plasma can explain some malfunctions and failures observed in orbiting spacecraft. N.E.N.

N71-16647*# Martin Marietta Corp., Denver, Colo.
ROCKET EXHAUST INITIATION OF CONDUCTION IN CONNECTORS AT ALTITUDE
R. W. Ellison *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 139-153 ref (See N71-16631 06-09)
Avail: NTIS CSCL 09C

The initiation of destruct circuits at staging of boosters was investigated in altitude chambers with simulated retrorocket exhaust. Anomalies attending the Stage 2 separation from Stage 3, Titan 3C, are identified and possible causes are discussed. Test results suggest that exhausts may connect separating stages, preventing exorbitant static voltage differences until separation exceeds the plume capabilities. Discussions of the Stage 2 pressure measurements dropout and Stage 2 telemetry are included. N.E.N.

N71-16648*# Harvard Coll. Observatory, Cambridge, Mass.
HIGH VOLTAGE BREAKDOWN IN AN OSO 4 POINTED EXPERIMENT
N. L. Hazen, M. C. E. Huber, and E. M. Reeves *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 155-168 refs (See N71-16631 06-09)
Avail: NTIS CSCL 09C

An analysis of the failure in the high voltage subsystem associated with the primary detector is discussed. Details are given of the scanning spectrometer design and preflight tests. The principal data characteristics of the failure after five weeks of in-flight service were unusually high primary current readings from the high voltage power supply, noise in the main digital system, and interaction with the mechanical reference circuitry. The probable failure mechanisms were reconstructed, and it is suggested that following launching, air trapped within the transformer leaked out of the module until the pressure reached a value favorable to high voltage breakdown between the leads or windings of the primary and secondary. Suggestions for improving manufacturing techniques, qualification and acceptance tests, circuitry, and turn-on plan in orbit are given. N.E.N.

N71-16649*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE PREVENTION OF ELECTRICAL BREAKDOWN IN SPACECRAFT
F. W. Paul and D. Burrowbridge *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 169-175 refs (See N71-16631 06-09)
Avail: NTIS CSCL 09C

A manual on the prevention of electrical breakdown is described. Illustrations of typical data in the manual, based on actual experience, are given. N.E.N.

N71-16651*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
BREAKDOWN STUDIES FOR POSSIBLE ATMOSPHERES ON MARS AND VENUS
J. A. Gardner *In its* Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 183-187 ref (See N71-16631 06-09)
Avail: NTIS CSCL 09C

Experimental data of gaseous breakdown resulting from an applied electric field are presented for three component mixtures of gases which are in the range of individual concentrations believed to exist on the planets Mars and Venus. The important parameters are the breakdown potential, and the product of gas pressure and electrode separation distance. These parameters are sufficient to generate the well-known Paschen curves. The applied voltages ranged from 0-7000 V, and the product of pressure and electrode separation ranged from 2-400 torr-cm. Author

N71-16652*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RF VOLTAGE BREAKDOWN IN COAXIAL TRANSMISSION LINES
R. Woo *In its* Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 189-192 refs (See N71-16631 06-09)
Avail: NTIS CSCL 09C

Data on breakdown in air for a 50-ohm coaxial line geometry are summarized. The experimental setups used (1) a 10-150 MHz

lumped circuit test set and (2) a 150–800 MHz and 1700–2400 MHz transmission line test set. The data are graphed and show the breakdown power (W) vs pressure-wavelength (torr-cm), frequency-separation distance (MHz-cm) vs pressure-wavelength, and minimum power handling capability vs frequency-separation distance. N.E.N.

N71-16883*# Stanford Research Inst., Calif.
REDUCTION OF GAS-DISCHARGE BREAKDOWN THRESHOLDS IN THE IONOSPHERE DUE TO MULTIPACTING
G. August and J. B. Chown *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 193–201 (See N71-16831 08-09)
Avail: NTIS CSCL 09C

Difficulties experienced with multipacting and test results are described. A multipactor discharge is defined as basically a resonance, resulting from the introduction of an electron into an RF field between two parallel or coaxial electrodes, and is sustained by secondary emission. The causes of the discharge and the resulting characteristics are listed, and the electron densities in the discharge are discussed. Details are given on the difficulties due to multipacting which were experienced in testing a log periodic antenna for gas discharge breakdown, and in testing single monopole elements. It is pointed out that one factor of great significance in multipactor discharge is that when multipacting starts on any electrode surface, a layer or monolayer of adsorbed gas molecules forms. N.E.N.

N71-16884*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
THE EFFECTS OF OUTGASSING MATERIALS ON VOLTAGE BREAKDOWN
J. F. Scannapieco *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 203–212 (See N71-16831 08-09)
Avail: NTIS CSCL 09C

Basic equations which regulate outgassing are reviewed, and their dependency on temperature and thickness is shown. An analogy is made between mass transfer or outgassing and radiant heat transfer, and a computer program initially written for radiant heat transfer is utilized to determine the condensation rate caused by mass transfer. The input requirement for this, instead of the normal thermal input, would be design data. This describes what design data are, how they are obtained, and shows how this aids in obtaining the quantitative analysis of the system to establish the pressure as a function of time and a condensate on the surface in the system as a function of time. A hypothetical black box having several simplifications is considered in order to provide a simpler illustration. The effects of outgassing are broken into two major categories, which aren't really separable. They are condensation and corona discharge; the latter includes arcover and multipacting, an associated phenomenon occurring at lower pressures. Author

N71-16885# Kentucky Univ., Lexington. Dept. of Chemistry.
EFFECT OF dc POLAROGRAPHIC MAXIMA ON ac WAVES
F. M. Hawkridge and H. H. Bauer Oct. 1970 13 p refs
(Contract DAAK07-69-C-0388)
(AD-714256; THEMIS-UK-RR-19) Avail: NTIS CSCL 7/4

The presence of a maximum on the d.c. polarographic curve does not preclude the possibility of a.c. studies of kinetics and mechanisms or of analytical determinations by a.c. polarography in absence of maximum suppressors. A necessary condition is that 3-electrode circuitry with potentiostatic control of the working electrode be used. The a.c. process is affected much less (if at all) than is the d.c. by the streaming that accompanies maximum formation. Author (GRA)

N71-16963*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ELECTRONIC PACKAGING AND CABLING
In its Space Programs Sum. No. 37-65, Vol. 3, Aug.–Sep. 1970 31 Oct. 1970 p 142–147 refs (See N71-16871 08-30)
Copyright. Avail: NTIS CSCL 09C

The results of an evaluation to determine the electrical, mechanical, and handling properties, and specific environmentally influenced characteristics of several small-gage electrical wire types are described. Candidate wire sizes and types were then selected for application to weight- and size-limited electronic packaging and cabling designs for future outer planet mission spacecraft. The evaluation was separated into three parts. Initially, preliminary screening tests were performed which included typical examination of product inspection and as-received measurements of principal electrical properties. Samples were then subjected to a detailed series of electrical, dimensional, physical, and handling property tests. The last part of the evaluation included selected environmental testing to determine the extent of exposure-related property changes. Author

N71-16737# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
APPROACH TO MULTIPARAMETRIC EDDY CURRENT NONDESTRUCTIVE TESTING USING PULSE TYPE WAVEFORMS
I. L. Bermen (Comision Nacl. de Energia Atomica, Buenos Aires)
Sep. 1970 21 p refs
(Contract AT(45-1)-1830)
(BNWL-1406) Avail: NTIS

The vector space concept as applied to the identification of test specimen parameters in nondestructive tests is reviewed. The analysis of the response of an exciting coil encircling a metal cylinder to a step function driving current is made to gain insight into the use of such a signal in an eddy current nondestructive test. A closed form approximate expression for this response function is obtained by starting with the classical series solution for the cylindrical case and applying the Euler–MacLaurin summation formula. The closed form approximation was checked experimentally using a coil encircling a stainless steel bar, and the measured and calculated results agree within explainable experimental error. The principles of orthogonal filters are reviewed and their application to the analysis of the test coil response function is discussed. Author (NSA)

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N71-16717# United Kingdom Atomic Energy Authority, Harwell (England)
INDUSTRIAL SCALE ION IMPLANTATION FACILITY
J. H. Freeman, L. R. Caldecourt, K. C. W. Done, and R. J. France Aug. 1970 9 p ref
(AERE-R-6496) Avail: AEC Depository Libraries

A machine designed for ion implantation on an industrial scale is described. The facility consists of a small isotope separator capable of delivering milliampere intensity beams of a wide range of ions, and an automatically controlled high voltage target chamber. The throughput depends upon both the required uniformity and dose, but is typically about thirty 10-cm-dia wafers per hour

for a dose of 5 × 10 to the 15th power ions/sq cm and a doping uniformity of approximately + or − 1%. The total combined energy of the separator and the target chamber is 200 keV, but a convenient maximum for routine operation is about 150 keV. For many dopants higher energies (> 300 keV) can be obtained by using doubly or triply charged ion beams. The target chamber was designed to cover a wide range of both industrial and experimental implantation requirements. Precise beam alignment can be achieved over large sample areas and provision for target heating and cooling is included. Author (NSA)

N71-15885# Texas Transportation Inst., College Station.
MICROTEXTURE MEASUREMENTS OF PAVEMENT SURFACES
Bob M. Gallaway and Hisao Tomita Feb. 1970 28 p refs Sponsored in part by Texas Highway Dept. and Dept. of Transportation
(PB-194159; RR-138-1) Avail: NTIS CSCL 13B

A review of texture-measuring techniques was made and a limited number of microtexture measurements of pavement surfaces was obtained with the Clevite BL-185 Surfindicator. This instrument is generally used to measure uniform textures on surfaces such as those found on finished metallic parts. The results of the investigation revealed that the Surfindicator has some undesirable features for measuring microtextures of pavement surfaces. Based on a limited number of tests, a trend was found between skid numbers at 40 mph and microtexture values; however, the correlation coefficient between the parameters was not very high. Significant differences between the microtextures of some pavement surfaces were determined by the device. Recommendations are given to continue microtexture measurements with the Surfindicator on a limited basis and to develop another instrument to obtain macrotextures as well as microtextures. Author (USGRDR)

N71-15925* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HYPERSONIC TEST FACILITY Patent
Frank L. Clark, Charles B. Johnson, Wayne D. Erickson, and Roger I. Buchanan, inventors (to NASA) Issued 1 Mar. 1966 (Filed 18 Mar. 1963) 10 p Cl. 219-10.49
(NASA-Case-XLA-00378; US-Patent-3,238,345; US-Patent-Appl-SN-266107) Avail: NTIS CSCL 14B

A hypersonic test facility is described for studying ablation in models under high pressure and high temperature conditions. It includes a heat exchanger with the capability of heating a test gas from room temperature to an exit temperature of 3,000 to 4,000 R, for sustained periods of time, by a graphite heater in a pressure chamber of 5,000 psi. The graphite heater element through which the test fluid passes is heated to a high temperature by induction, and is expanded through a water-cooled nozzle to the test section. F.O.S.

N71-15926* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TEST UNIT FREE-FLIGHT SUSPENSION SYSTEM Patent
Wilmer H. Reed, III, inventor (to NASA) Issued 4 Oct. 1966 (Filed 16 Sep. 1963) 7 p Cl. 73-147
(NASA-Case-XLA-00939; US-Patent-3,276,251; US-Patent-Appl-SN-309354) Avail: US Patent Office CSCL 14B

A free flight suspension system is described for use with aircraft models in wind tunnels. Pulleys mounted on the test model, arranged so that cables connected to the top, bottom and sidewalls, entrained over the pulleys provide six degrees of freedom for the model in wind tunnel tests. F.O.S.

N71-15960* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MEANS FOR CONTROLLING RUPTURE OF SHOCK TUBE DIAPHRAGMS Patent
Donald Baganoff, inventor (to NASA) Issued 25 Aug. 1964 (Filed 22 Oct. 1962) 4 p Cl. 220-89 Sponsored by NASA
(NASA-Case-XAC-00731; US-Patent-3,145,874; US-Patent-Appl-SN-232318) Avail: US Patent Office CSCL 14B

A means for ensuring precise control of the rupture pressure and a knife structure for rupturing the diaphragm are described. The shock tube consists of a low pressure tube and a compression tube separated by a diaphragm. The knife structure has several cutting blades radiating from a common center. It is positioned under the diaphragm, of sheet aluminum or aluminum alloy, so that the diaphragm balloons or stretches against the knife edges at the desired pressure. Upon rupturing, the diaphragm forms segmented leaves which are attached to the diaphragm and fold down against the walls of the low pressure section. N.E.N.

N71-16028* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
REDUCED GRAVITY SIMULATOR Patent
Donald E. Hewes and Amos A. Spady, Jr., inventors (to NASA) Issued 6 Sep. 1966 (Filed 26 Aug. 1963) 10 p Cl. 35-29
(NASA-Case-XLA-01787; US-Patent-3,270,441; US-Patent-Appl-SN-304749) Avail: US Patent Office CSCL 05H

A cable suspension system is described which supports the subject at a desired inclination and allows him to move freely. The body supports are suspended from an overhead trolley unit mounted on a monorail track parallel to an inclined walkway. The trolley unit runs directly over the subject as he moves along the walkway. The inclination of the walkway determines the amount of simulated gravity: A vertical walkway simulates zero gravity, and an angle of 80.5 deg from the vertical produces the equivalent of lunar gravity. N.E.N.

N71-16029*# North Carolina State Univ., Raleigh. Center for Acoustical Studies.
ENGINEERING ANALYSIS AND DESIGN OF A MECHANISM TO SIMULATE A SONIC BOOM
Rolin F. Barrett and Lawrence W. Redman Aug. 1970 61 p refs
(Grant NGL-34-002-095)
(NASA-CR-111839) Avail: NTIS CSCL 14B

A mechanism to simulate the vibrational and acoustic properties of a sonic boom was designed. The simulator reproduces the effects of sonic booms having N-wave shape with rise times as low as ten milliseconds, durations as short as 161 milliseconds, and peak overpressures as high as three pounds per square foot. A systematic engineering analysis was performed to establish the best simulator design. Each design was examined to ascertain its ability to generate the properties of a sonic boom, its ease of adjustment, and its lack of background noise. The final design chosen employs a moving circular diaphragm which creates the required pressure variations by altering the volume of an airtight chamber connected to an acoustical testing room. The diaphragm is designed so that a minimum of force is required for its movement. The movement of the diaphragm is controlled by the rotation of a specially designed adjustable cam, and a constant force air cylinder. Author

N71-16080# Advisory Group for Aerospace Research and Development, Paris (France).
SIMULATION AGARD CONFERENCE PROCEEDINGS
Jan. 1971 188 p refs AGARD Flight Mech. Panel Specialists Symp. held at Moffett Field, Calif, 10-13 Mar. 1970
(AGARD-CP-79-70) Avail: NTIS

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8. ENGINEERING ANALYSIS M. Monfort (Centre d'Essais en Vol Istres, France) 22 p refs (See N71-16068 06-11)

9. PILOT ASSESSMENT ASPECTS OF SIMULATION G. E. Cooper and F. J. Drinkwater, III (NASA. Ames Res. Center) 18 p refs (See N71-16069 06-11)

N71-16061# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.

SIMULATION: AN INTRODUCTION AND SURVEY

Gerhard F. Bruening *In* AGARD Simulation Jan. 1971 18 p refs (See N71-16060 06-11)

Avail: NTIS

A review is given on the state of the art of simulation. Linearized control theoretical aspects of simulation are discussed and examples of fixed base, moving base, and in-flight simulators are depicted with emphasis on the V/STOL problem. Ground simulators for environmental factors are analyzed with respect to motion, visual, and psychological parameters and methods for their simulation. The use of pilot opinion rating for evaluating simulation results is advocated. Differences between simulation on the ground and in the air are also outlined. G.G.

N71-16062# British Aircraft Corp., Preston (England).

OBJECTIVES OF SIMULATION

A. G. Barnes *In* AGARD Simulation Jan. 1971 8 p (See N71-16060 06-11)

Avail: NTIS

Simulations are used to: (1) derive statements about properties of a system which may be read across to real situations; (2) provide a framework for the interpretation of experiments; (3) improve a model; and (4) suggest further experiments. Flight simulation experiments provide accelerated development of aircrafts at reduced costs by defining what is required in order to transfer results readily with increased confidence to the real situation and thus cut down on trial and error aspects. G.G.

N71-16063# Boeing Co., Seattle, Wash.

LIGHT SIMULATOR MATHEMATICAL MODELS IN AIRCRAFT DESIGN

Alan H. Lee *In* AGARD Simulation Jan. 1971 23 p refs (See N71-16060 06-11)

Avail: NTIS

Mathematical models are discussed from the viewpoint of a flight simulation user. Aerodynamic, flight control system, and atmospheric environment models are stressed. Some of their considerations are discussed relative to aircraft design phases. A quasi-elastic format for representing the aerodynamic characteristics of a large, flexible aircraft is described. It is shown that storing aerodynamic data in digital computers as split functions has advantages. Such items as controller feel, hysteresis, and actuator characteristics should be included in the flight control system mathematical model. Turbulence and wind shears are essential to any realistic simulation program. The von Karman power spectral density function is preferred for turbulence generations. Emperical wind shears are also useful. Author

N71-16064# Royal Aircraft Establishment, Bedford (England).

MOTION, VISUAL AND AURAL CUES IN PILOTED FLIGHT SIMULATION

K. J. Staples *In* AGARD Simulation Jan. 1971 25 p refs (See N71-16060 06-11)

Avail: NTIS

The main characteristics of motion, visual and aural cues, are discussed for their integration into pilot flight simulation studies on variable stability aircraft. Areas of relevance and importance are defined for each of the cues and their interaction and substitution of one by another is considered. It is proposed that the principal attraction of simulation is speed and versatility in obtaining valid results for optimal man machine integration. G.G.

N71-16065# Societe Nationale Industrielle Aerospatial, Toulouse (France).

COCKPIT ENVIRONMENT

Jean Pinet *In* AGARD Simulation Jan. 1971 13 p refs (See N71-16060 06-11)

Avail: NTIS

Various inputs of the simulation environment during Concorde cockpit development are considered. Computerized simulator trials started out with the variable stability Mirage 3B aircraft by considering external and internal visual displays, inertial perceptions, and aural perception and verbal communications. Confrontation between simulation objectives and inputs and outputs of the crew members transfer functions with results from the various indices was used to define the environment simulation degree. G.G.

N71-16066# National Research Council of Canada, Ottawa (Ontario).

SOME FACTORS INFLUENCING THE CHOICE OF A SIMULATOR

D. M. McGregor *In* AGARD Simulation Jan. 1971 33 p refs (See N71-16060 06-11)

Avail: NTIS

Some of the means by which the pilot derives motion information during flight and attempts to highlight some of the areas in which specific simulator characteristics are required to obtain valid results are outlined. Discussions of several shortcomings of present hardware that must be overcome before specific tasks, such as low altitude, low speed maneuvering flight, can be simulated adequately and the difficulties of achieving a thorough understanding of the man-machine system are presented. Author

N71-16067# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.

THE SELECTION OF TASKS AND SUBJECTS OF FLIGHT SIMULATION EXPERIMENTS

Waldemar O. Beuhaus and Robert P. Harper, Jr. *In* AGARD Simulation Jan. 1971 17 p (See N71-16060 06-11)

Avail: NTIS

The limitations of various simulators directly affect the simulation tasks which can be performed and, hence, affect the validity of the evaluation results obtained. The ability of simulator pilots to produce valid and repeatable evaluations which are

applicable to the real-world situation can be no better than the accuracy with which the simulator tasks represent the essential characteristics of the real world. Certain considerations in the selection of simulator tasks are discussed, and problems are set forth which should be considered in the design of simulation experiments. The selection and preparation of evaluation pilots are discussed in terms of the factors which appear to have substantial effects upon the program results. Experience in the real-world mission is one of several key elements which greatly enchances the evaluation results. Preparation of subjects considers the importance and nature of communication between the subject pilot and the analyst, and participation of the subjects in the experimental design. Author

N71-16068# Centre d'Essais en Vol, Istres (France).
ENGINEERING ANALYSIS
M. Monfort *In* AGARD Simulation Jan. 1971 22 p refs (See N71-16060 06-11)
Avail: NTIS

The mixing of several simulation methods is advocated for engineering analyses on flight mechanics. Emphasis is placed on analysis of the pilot's behavior for integration in the man-machine system by application of statistical and response surface techniques to both pilot ratings and pilot comments in measuring the pilot's workload. G.G.

N71-16069*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PILOT ASSESSMENT ASPECTS OF SIMULATION
George E. Cooper and Fred J. Drinkwater, III *In* AGARD Simulation Jan. 1971 18 p refs (See N71-16060 06-11)
(NASA-TM-X-66583) Avail: NTIS CSCL 05H

Pilot assessment aspects of flight simulation consider the use of pilot ratings in the evaluation of aircraft handling qualities. Critical questions raised by pilots are examined and discussed in order to develop solutions and improve understanding. It is important to involve the pilot as early as possible in developing a piloted simulation program by considering complaints arising from simulation experiences as well as questions arising related to the pilot's actual participation in the planning and conducting of experiments, the simulation facility, and the analysis of results. Author

N71-16256# National Accelerator Lab., Batavia, Ill.
THE 1969 SUMMER STUDY. VOLUME 2: BUBBLE CHAMBERS
Arthur Roberts, ed. 1969 316 p refs Sponsored by AEC
(TID-25473-Vol-2) Avail: NTIS

Study lectures are presented on the following topics: 25-ft bubble chamber physics, including strong interactions, electron momentum errors, photoproduction, and neutrino experiments; and the physical aspects of bubble chamber technology, including cosmic ray and muon background experiments. NSA

N71-16317# Stanford Linear Accelerator Center, Calif.
VACUUM SYSTEM FOR STANFORD STORAGE RING, SPEAR
U. Cummings, N. Deav, F. Johnson, J. Jurow, and J. Voss Sep. 1970 15 p refs Presented at the 17th Natl. Vacuum Symp., Washington, D.C., 20–23 Oct. 1970
(Contract AT(04-5)-515)
(SLAC-PUB-797; CONF-701011-1) Avail: NTIS

Due to its unusual geometry and gas load, the SPEAR vacuum system incorporates several unique design features. The system consists of an aluminum chamber in the form of a 200-foot diameter ring which must achieve a pressure in the 10 to the minus 9th power torr range with a large gas load due to synchrotron radiation induced desorption. Since the system is conductance limited, it was necessary to develop distributed sputter ion pumps located within the chamber proper. A large number of aluminum-to-stainless steel interfaces required the development and testing of various flange arrangements which would withstand a bakeout to 200 C. Author (NSA)

N71-16452# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
THICKNESS REQUIREMENTS FOR UNSURFACED ROADS AND AIRFIELDS: BARE BASE SUPPORT Final Report, May – Oct. 1968
George M. Hammitt, II Jul. 1970 149 p refs
(AD-713897; AEWES-TR-S-70-5) Avail: NTIS CSCL 1/5

A method was developed for determining design thickness requirements for unsurfaced airfields. Tests were conducted on a total of 43 unsurfaced test items. These items had varying thicknesses and were trafficked under different loading conditions. CBR, water content, density, deflection, and deformation data were recorded throughout testing. The design expression relates thickness requirements to soil response in terms of applications of load, load magnitude and pressure, and strength of soil. Author (GRA)

N71-16549# ARO, Inc., Arnold Air Force Station, Tenn.
WIND TUNNEL PRESSURE MEASURING TECHNIQUES Final Technical Report 1969 – 1970
D. S. Bynum, R. L. Ledford, and W. E. Smotherman AEDC Nov. 1970 102 p refs
(Contract F40600-70-C-0002)
(AD-714565; AEDC-TR-70-250) Avail: NTIS CSCL 14/2

The report was written to give those unacquainted with modern wind tunnel pressure measuring techniques and equipment a broad view of the topic and to provide sufficient references so that additional information may be easily obtained. The material covered is limited to direct pressure measurements, i.e., force per unit area, and does not present techniques that determine pressure through its relationship to other measured parameters. Transducers, signal conditioning, data recording equipment, and static and dynamic calibrations are described. Author (GRA)

N71-16670*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
LANDING AIRFIELDS SELECTION WITH IMPLICIT DESIGNS AND OPERATIONS FOR SHUTTLE ORBITERS
Jonny E. Ferguson, George L. Richeson, and Millard C. Pettit 15 May 1970 67 p refs
(NASA-TM-X-66602; MSC-02438) Avail: NTIS CSCL 01E

The selection of optimum airfields for support of landings from earth orbit of future reusable land-landing type spacecraft, the space shuttle orbiter, is investigated to aid in design development and operations planning. The selection of a minimum number of unique airfields is reported that provide the maximum number of landing opportunities possible and the minimum duration of in-orbit waits possible for the entire shuttle program, as presently proposed. Some design recommendations and an operational philosophy for the shuttle orbiter are also presented. The airfields were selected from those currently available in the free world. They are the best equipped airfields available and should require no modifications to support shuttle landings. The airfields were also selected to furnish landing opportunities for four distinct types of orbiter landings. Author

N71-16753# Brookhaven National Lab., Upton, N.Y. Accelerator Dept.
COMPUTED PROPERTIES OF A TWO-DIMENSIONAL SECTION OF THE 2-INCH-BORE, 40-kG-AC DIPOLE

P. F. Dahl, G. H. Morgan, and Anne Young 18 Sep. 1970 9 p refs Sponsored by AEC
(BNL-15174) Avail: NTIS

The computed effects of several iron configurations on the stored energy, field quality, superconducting hysteretic loss, and other properties of a proposed 2-in.-bore synchrotron dipole are presented. Author (NSA)

N71-16760# California Univ., Berkeley. Lawrence Radiation Lab.
EFFECT OF VERTICAL LENS AT RADIAL REGENERATION NODE IN BERKELEY 184-INCH SYNCHROCYCLOTRON
A. C. Paul and H. Grunder Aug. 1970 7 p refs
(Contract W-7405-eng-48)
(UCRL-20049) Avail: NTIS

An attempt is made to understand and correct the vertical growth in the peeler of the 184-inch cyclotron. It is shown that a vertically focusing quadrupole field with its origin at the radial regeneration node improves the extraction efficiency somewhat, but cannot make all vertical orbits stable. Author (NSA)

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N71-15787# National Physical Lab., Teddington (England). Div. of Numerical and Applied Mathematics.
NUMERICAL SOLUTION OF A BOUNDARY-VALUE PROBLEM
G. T. Symm Oct. 1970 20 p refs
(NPL-MA-89) Copyright. Avail: NTIS

A mixed boundary-value problem for Laplace's equation arising in the study of forced oscillations of liquids in tanks with pressure chambers is considered. The numerical solution is obtained by means of an integral equation method of potential theory. Author (ESRO)

N71-15788# National Physical Lab., Teddington (England). Aerodynamics Div.
A COMMENT ON THE DETERMINATION OF CENTRE OF PRESSURE POSITION FOR A BLUNTED CONE OF 9 DEG HALF ANGLE USING FREE-FLIGHT AND FORCE BALANCE TECHNIQUES IN 3 HYPERSONIC FACILITIES
L. Davies Nov. 1969 10 p refs
(NPL-AERO-NOTE-1085; ARC-31670) Copyright. Avail: NTIS

It was not possible to resolve all the discrepancies between these sets of data by allowing for conical flow effects. ESRO

N71-15789# Cambridge Univ. (England). Dept. of Engineering.
FURTHER EXPERIMENTAL INVESTIGATIONS OF COMPRESSIBLE TURBULENT BOUNDARY LAYERS WITH AIR INJECTION
L. C. Squire London Aeron. Res. Council 1970 40 p refs Supersedes ARC-30437
(ARC-R/M-3627; ARC-30437) Copyright. Avail: NTIS; HMSO: £ 1.05; BIS: $3.78

By a slight injection equipment modification of available apparatus and by a reduction in Reynolds number, it was possible to obtain a threefold increase in injection rate at a Mach number of 2.5. Results were also obtained for a Mach number of 1.8. The results, together with those for incompressible flow, were used to study the law of the wall, the velocity defect law, and the eddy viscosity variation through the layer. Author (ESRO)

N71-15804# Aeronautical Research Council (Gt. Brit.).
STUDIES OF THE TURBULENT BOUNDARY LAYER ON A WAISTED BODY OF REVOLUTION IN SUBSONIC AND SUPERSONIC FLOW
K. G. Winter (RAE, Bedford), J. C. Rotta (Aerodyn. Versuchsanstalt), and K. G. Smith (RAE, Bedford) 1970 79 p refs Supersedes RAE-TR-68215; ARC-30935
(ARC-R/M-3633; RAE-TR-68215; ARC-30935) Copyright. Avail: NTIS; HMSO: £ 2; BIS: $7.20

The influence of Mach number, pressure gradients, and streamline convergence and divergence on the development of turbulent boundary layers was studied. Measurements were made of pressure distribution, local skin friction and boundary-layer profiles along the body, at Mach numbers between 0.6 and 2.8 and Reynolds numbers, based on the length of the body, between 5 and 20 million. The results of comparative calculations based on simultaneous integration of the momentum and kinetic energy equations were in fair agreement with the experiments except at Mach numbers 2.4 and 2.8. Author (ESRO)

N71-15807# Sussex Univ., Brighton (England).
SOME OBSERVATIONS ON THE HEAT TRANSFER CHARACTERISTICS OF A ROTATING MIXED CONVECTION THERMOSYPHON
W. D. Morris London Aeron. Res. Council 1970 21 p refs Supersedes ARC-31064
(ARC-CP-1115; ARC-31064) Copyright. Avail: NTIS; HMSO: 6s; BIS: $1.20

The heat transfer performance of a rotating mixed convection thermosiphon using water and 100% glycerol is shown to be enhanced with increases in rotational speed and can be used for cooling rotating components in high temperature environments. Author (ESRO)

N71-15808*# National Bureau of Standards, Boulder, Colo. Inst. for Basic Standards.
TWO-PHASE (LIQUID-VAPOR), MASS-LIMITING FLOW WITH HYDROGEN AND NITROGEN
J. A. Brennan, D. K. Edmonds and R. V. Smith Repr. from Advan. in Cryog. Eng., v. 14, 1969 p 294 298 refs
(NASA Order R-45)
(NASA-CR-116003; PB-188216; R-532) Avail: NTIS CSCL 20D

Experimental data are presented for choking, two-phase flow of hydrogen and nitrogen. The general behavior of this flow may be described by the use of simple analytical models as is the case of more conventional fluids. Except at low quality flow, the use of models provides upper and lower limits for choking flow of hydrogen and nitrogen in liquid-vapor mixtures. Further detailed analytical and experimental work would be required to provide a more accurate predictive system for such flow. Author (USGRDR)

N71-15809*# National Bureau of Standards, Boulder, Colo. Inst. for Basic Standards.
CAVITATION IN LIQUID CRYOGENS
D. K. Edmonds and J. Hord Repr. from Advan. in Cryog. Eng., v. 14, 1969 p 274 282 refs
(NASA Order C-35560-A)
(NASA-CR-116004; PB-188217; R-531) Avail: NTIS CSCL 20D

Some characteristic data for developed cavitation in both hydrogen and nitrogen are given in the form of pressure-depression curves. These curves show that the pressure and temperature in

the cavity are generally not in thermodynamic equilibrium. Recent data are used to analyze and evaluate the basic similarity-equation theory and to compare these results with the experimental work of others; the cavity thickness ratio is assumed to be unity. An analytical method, to account for variations in cavity thickness, is proposed and evaluated using the experimental hydrogen data; the results are again compared with the experimental work of others. The proposed method holds some promise for improvement of the cavitation similarity equation. Author (USGRDR)

N71-15828*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

FLOW FIELD RESULTING FROM FORWARD-FACING NOZZLES EXHAUSTING NEAR A LARGE CYLINDRICAL BODY AT FREE-STREAM MACH NUMBERS OF 3.0, 4.5, AND 6.0

James A. Martin and Robert J. McGhee Washington Jan. 1971 60 p refs

(NASA-TN-D-6103; L-7333) Avail: NTIS CSCL 20D

Effects of nozzles exhausting forward near a large cylindrical body have been investigated for free-stream Mach numbers of 3.0, 4.5, and 6.0 and Reynolds numbers per meter from 2.6 million to 6.6 million. Jet pressure, forebody shape, centerbody length, number of nozzles firing, and jet Mach number were varied. The extent of the nozzle-exhaust flow was constrained by the location of the bow shock wave. Free-interaction transitional and turbulent separation existed as well as separation at the forebody-cylinder juncture. Jet stagnation pressure, jet static pressure, and jet mass flow appeared to be the dominant nozzle parameters. Author

N71-15834*# Martin Marietta Corp., Denver, Colo.

EXPERIMENTAL INVESTIGATION OF THE NONEQUILIBRIUM RADIATION EMITTED BY MARS-LIKE GAS MIXTURES

Jackie O. Bunting Washington NASA Jan. 1971 35 p refs

(Contract NAS1-9471)

(NASA-CR-1740; MCR-70-155) Avail: NTIS CSCL 20D

The spectral radiative intensity has been measured under various test conditions for three different candidate Mars atmospheres over the wavelength range from 0.275 to 5.0 microns. The infrared portion of the spectral radiation for all three gas mixtures tested show a peak in intensity between 4.3 and 5.0 miorons corresponding to the fundamental rotation-vibration band of CO2 and the 5.0 micron bands of CO2. The 100 percent CO2 test gas also shows a strong band radiation at 2.7 microns and this strong peak is greatly reduced when either nitrogen or argon are added to the test gas mixture. The nonequilibrium radiation that appears in the infrared always occurs in those spectral regions for which the equilibrium levels are lowest. Maximum observed nonequilibrium overshoots occur in the visible portion of the spectrum and are generally no larger than two times the equilibrium value. The major portion of both the infrared and the visible spectrums have nonequilibrium overshoots less than 1.5 times the equilibrium values. Author

N71-15989*# New York Univ., N.Y. School of Engineering and Science.

COMBINED CONDUCTION, CONVECTION AND RADIATION EFFECTS IN INTERNAL FLOWS PARTICIPATING GASES

Richard S. Thorsen Sep. 1970 60 p refs

(Grant NGL-33-016-067)

(NASA-CR-116127; F-70-2) Avail: NTIS CSCL 20D

A general formulation is presented for determining the gas and surface temperature distributions for laminar flow in a circular tube. The analysis allows for arbitrary wall heat generation and radiation effects in the gas and at the tube surface. Though optically thin radiation is considered for purposes of obtaining numerical results with water vapor as the fluid, the analytical development is applicable to more general radiation situations, any gas for which the relevant properties are known, and to fluids with heat sources due to effects other than radiation. Numerical results are presented for a variety of parameters, selected to demonstrate important qualitative trends. By comparing the results with results obtained for non-participating gases (surface radiation effects considered) it is found that for a prescribed wall heat generation the non-participating gas solution represents a poor estimate of the wall temperature distribution as well as the gas bulk temperature variation. It is also demonstrated that introducing a so called quasi-one dimensional approximation for the radiation term in the energy equation simplifies the computational procedure without sacrificing accuracy. Author

N71-16031* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

FLUID POWER TRANSMISSION Patent

Harold I. Johnson and Orrin A. Wobig, inventors (to NASA) Issued 14 Mar. 1967 (Filed 27 Jul. 1964) 7 p Cl. 137-617

(NASA-Case-XMS-01445; US-Patent-3,308,848; US-Patent-Appl-SN-385526) Avail: US Patent Office CSCL 20D

An apparatus is described which provides separate air supplies at different pressure levels for the fluid power transmission and support for the floated bearings. A socket with small holes distributed in annular zones is connected to a high pressure gas supply for supporting a close-fitting bearing. The socket base has a larger centrally located opening connected with gas supply maintained at a lower pressure. Through the middle of the bearing is a passageway, for the fluid transmission, which is normally aligned with the central socket opening. The bearing motion has three degrees of freedom and is limited only by the dimensions of the socket opening and the recess at the terminal end of the flow passage. N.E.N.

N71-16082# Air Force Systems Command, Wright-Patterson AFB, Ohio. Flight Dynamics Lab.

THREE-DIMENSIONAL LAMINAR FLOW IN A RECTANGULAR DUCT WITH POROUS WALLS Final Report, Jun. 1968–Jun. 1969

Lawrence L. Midolo Sep. 1970 42 p refs

(AD-714555; AFFDL-TR-70-47) Avail: NTIS CSCL 20/4

A three-dimensional velocity profile for laminar flow in a rectangular duct with two parallel porous walls was developed analytically. The Navier-Stokes equations were solved, assuming an appropriate stream function. The final equation to be solved is a fourth-order nonlinear partial differential equation. The analysis demonstrates the successful use of the perturbation method to solve three-dimensional nonlinear incompressible flow problems. Author (GRA)

N71-16116# Massachusetts Inst. of Tech., Cambridge. Engineering Projects Lab.

FLUID AMPLIFIER JET DYNAMICS Final Report, 1 Sep. 1969–31 Aug. 1970

Forbes R. Brown Sep. 1970 24 p ref

(Contract DAHC04-69-C-0092)

(AD-714698; AROD-8683-2-E) Avail: NTIS CSCL 13/7

The problem of a submerged incompressible two-dimensional jet pivotally oscillated at its base was studied analytically and experimentally. The analysis, corroborated by experiment, shows that the phase velocity of the propagating disturbances is much less than the jet velocity of for most frequencies of interest. Futher, the amplitudes grow faster than linearly, with the rate dependent on frequency. These results have considerable implications for the

dynamics and noise generation of fluidic amplifiers. All of the desired boundary conditions have not yet been accommodated analytically, and the experiment needs a refined method for dyeing the jet. Author (GRA)

N71-16120# Massachusetts Inst. of Tech., Cambridge. Fluid Dynamics Lab.
SOLUTIONS FOR A SOURCE-LIKE DISTURBANCE IN A WEAKLY NONUNIFORM POTENTIAL FLOW Final Scientific Report
Marten T. Landahl Mar. 1970 31 p refs
(Contract AF 49(638)-1622)
(AD-714113; Rept-70-1; AFOSR-70-0808TR) Avail: NTIS CSCL 20/4

Solutions valid to first order in flow nonuniformity are determined for a source-like infinitesimal disturbance embedded in a two-dimensional or axisymmetric subsonic or supersonic potential flow. A transformation is presented which gives the solutions directly in terms of the familiar ones for a uniform flow. With the aid of parametric differentiation, formally exact solutions are also constructed for a general three-dsional flow, but these are found to be computationally quite unwieldy. An approximation is instead proposed, which is based on the axisymmetric solution and which is found to produce the correct first-order solution in simple cases of flow nonuniformity. The solutions presented are developed primarily for use in calculations of nonlinear flow fields with the method of parametric differentiation, but may also be useful in flow interference problems as well as in the calculation of corrections due to wind tunnel flow imperfections. Author (GRA)

N71-16217# ARO, Inc., Arnold Air Force Station, Tenn.
EDDY VISCOSITY-INTERMITTENCY FACTOR APPROACH TO NUMERICAL CALCULATION OF TRANSITIONAL HEATING ON SHARP CONES IN HYPERSONIC FLOW Final Report, Jul. 1969 – Mar. 1970
John C. Adams, Jr. Arnold Eng. Develop. Center Nov. 1970 79 p refs
(Contract F40600-71-C-0002)
(AD-714058; AEDC-TR-70-210; ARO-VKF-TR-70-198) Avail: NTIS CSCL 20/4

Analysis of laminar, transitional, and turbulent boundary layers on a sharp cone at zero angle of attack under hypersonic perfect gas conditions is presented. The governing boundary-layer equations were numerically integrated on a digital computer using a marching, iterative, implicit, finite-difference method. The turbulent boundary layer is analyzed using a two-layer eddy viscosity model with a constant turbulent Prandtl number, and the transition region is treated through an eddy viscosity-intermittency factor approach. Comparison with experimental data reveals that the approach yields an accurate description of laminar, transitional, and fully turbulent heat transfer on sharp cones in the Mach number range from 5 to 10 under cold wall conditions. Verification of the detailed calculation of transitional and turbulent boundary-layer structure under hypersonic conditions must await further experimental investigations. It appears that the eddy viscosity approach to calculation of transitional and turbulent boundary layers may indeed be applicable and accurate under hypersonic conditions. Author (GRA)

N71-16218# Ohio State Univ. Research Foundation, Columbus.
HYPERSONIC VISCOUS INTERACTION ON CURVED SURFACES
John L. Stollery Wright-Patterson AFB, Ohio ARL Jul. 1970 42 p refs
(Contract F33615-67-C-1758)
(AD-714075; ARL-70-0126) Avail: NTIS CSCL 20/4

Chengs analysis of strong viscous interaction between a laminar boundary layer growing over a flat plate and the external hypersonic flow field is extended to cover curved surfaces. It is demonstrated that the solutions for concave surfaces are oscillatory and physically unrealistic. The reason for this behavior is that the Busemann term in the Newton-Busemann pressure law used in Chengs analysis over-corrects for centrifugal effects. The removal of the Busemann term or the substitution of the tangent-wedge pressure law results in a more realistic analysis which can cover both strong and weak viscous interaction over a variety of two-dimensional shapes. A number of examples are included together with comparative experimental data. Author (GRA)

N71-16290# Ohio State Univ. Research Foundation, Columbus.
HYPERSONIC VISCOUS INTERACTION. AN EXPERIMENTAL INVESTIGATION OF THE FLOW OVER FLAT PLATES AT INCIDENCE AND AROUND AN EXPANSION CORNER
John L. Stollery Wright-Patterson AFB, Ohio ARL Jul. 1970 48 p refs
(Contract F33615-67-C-1758)
(AD-714074; ARL-70-0125) Avail: NTIS CSCL 20/4

Flat plate and expansion corner models were tested over a range of positive and negative incidences in a continuous hypersonic wind tunnel operating at M = 14.8. Surface pressure distributions were obtained for comparison with the viscous interaction theories of Cheng and Sullivan. Since these theories assume local flat plate similarity for the boundary layer flow, pitot pressure profiles were measured at various stations along the plates. It often proved difficult to define the boundary layer edge within the shock layer and total temperature profiles would greatly assist in interpreting the data. Schlieren pictures and oil flow visualization gave good indications of the extent of end effects, the onset of separation caused by the trailing edge shock wave, and tunnel blocking at high model incidence. The tests have provided some new hypersonic experimental data under conditions where both strong viscous interaction and incidence effects are important. Author (GRA)

N71-16309# Naval Ship Research and Development Center, Washington, D.C. Dept. of Aerodynamics.
NUMERICAL DETERMINATION OF THE FLOW FIELD ABOUT AXISYMMETRIC AND TWO-DIMENSIONAL BODIES IN SUPERSONIC FLOW
Robert H. Thompson and Roger J. Furey Mar. 1970 91 p refs
(AD-713917; Aero-1162; NSRDC-3032) Avail: NTIS CSCL 20/4

A computer program for calculating the aerodynamic characteristics and local flow properties for an arbitrary axisymmetric or two-dimensional body in supersonic flow is developed. The supersonic portion of the flow field is calculated by the method of characteristics. A conical flow solution provides the starting conditions for a sharp body with an attached shock; for a blunt body detached shock case, a method of integral relations solution provides the starting conditions. The flow field is treated as inviscid with the boundary layer effects being determined by the reference temperature method and a modified Reynolds analogy in the laminar case and the method of Spalding and Chi in the turbulent case. Manglers transformation accounts for transverse curvature in the laminar flow case. Details of the entire flow field are provided including any secondary shocks which may arise as a result of overexpansion or flared surfaces. Base flow properties are provided by the semiempirical method of Love. The calculated surface properties include pressure, equilibrium temperature, skin friction and heat transfer coefficients, and Mach number. Drag coefficients are determined with the components being broken down into pressure, friction and base contributions. Author (GRA)

N71-16312# Hydronautics, Inc., Laurel, Md.
BOUNDARY LAYER OVER UNIFORM ROUGHNESS
Jin Wu Oct. 1970 29 p refs
(Contracts Nonr-4181(00); N00019-70-C-0276)
(AD-714021; TR-353-8) Avail: NTIS CSCL 20/4

The boundary-layer survey is conducted of a rough plate consisting of uniform spherical particles arranged in a random and in highly compact fashion. Strong turbulent mixing is observed in a region within a quarter of the particle size from the top of the particle. The datum of the normal axis of this rough surface is found to be located at a distance of 1/50 of the particle diameter below the top of the particle. Based on these findings, problems such as roughness criterion in aeolian sand transport, Karman constant in suspension streams, entrainment of grains from sand bed, and dilution of mass ejection from the wall are discussed. Author (GRA)

N71-16318# California Univ., Berkeley. Div. of Aeronautical Sciences.
DEVELOPMENT OF THE DISTRIBUTION FUNCTION ON THE CENTERLINE OF A FREE JET EXPANSION
D. Roger Willis, B. B. Hamel, and J. Lin Sep. 1970 33 p refs
(Contract N00014-69-A-0200-1021)
(AD-714155; AS-70-8) Avail: NTIS CSCL 20/4

Spherical source flow, which closely approximates the flow on the centerline of an axisymmetric free jet expansion, is used as a theoretical model. The ellipsoidal statistical model is used to describe the intermolecular collisions. Three partial moments of the distribution function and the value of the distribution function for a zero perpendicular component of molecular velocity are calculated as functions of distance and molecular velocity. Author (GRA)

N71-16385# Oak Ridge National Lab., Tenn.
MSF EVAPORATOR FLOW ANALYSIS: THE SUBMERGED JET MODEL AND THE EFFECT OF BAFFLES ON FLOW STABILITY
R. P. Wichner Oct. 1970 46 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3120) Avail: NTIS

Flow data taken in a three-stage, nonflashing mockup of an MSF evaporator were correlated with an accuracy of + or − 5.9% by an equation derived from an assumed submerged jet flow model. The correlation is valid for the entire range of flowrates, orifice heights, and applied interstage pressure differences tested. The best value of the contraction coefficient was found to be about 0.7 for depths in the upstream stage greater than 1.5 times the orifice height, somewhat lower than the 0.72 to 0.75 range that limited velocity profile data indicated. The contraction coefficient was found to increase as the upstream depth fell below 1.5 times the orifice height. An equation for nonflashing flow through a baffled orifice in an MSF evaporator is derived based on an idealized model. Author (NSA)

N71-16396# Michigan State Univ., East Lansing. Div. of Engineering Research.
FOUR-PART STUDY ON BOUNDED AND INTERSECTING JETS Final Report
J. F. Foss 15 Aug. 1970 10 p refs
(Contract DAAG39-68-C-0034)
(AD-714656) Avail: NTIS CSCL 20/4

An extensive investigation of bounded and intersecting plane, incompressible, turbulent jets is reported. The objective of both the bounded and intersecting jet studies was to establish rational (fluid mechanics) flow models for both flow fields. Further objectives were (1) to use the intersecting jets model to determine the optimum geometry for a high-gain proportional amplifier, and (2) to predict the aspect ratio dependence of the secondary flow and other three-dimensional effects in the bounded jet. The desired flow models were established on a qualitative basis and interpreted with respect to the objectives for the separate studies. Author (GRA)

N71-16398# Purdue Univ., Lafayette, Ind. Project SQUID Headquarters.
PROJECT SQUID Semiannual Progress Report, 1 Apr.–30 Sep. 1970
J. B. Anderson, R. A. Dobbins, J. B. Fenn, A. Kontijn, and J. L. Franklin 1 Oct. 1970 73 p refs
(Contract N00014-67-A-0226-0005)
(AD-714236) Avail: NTIS CSCL 21/2

Contents: Fluid mechanics; Atomic and molecular collisions; Combustion and chemical rate processes; and Chemi-ionization and ion-molecule reactions. GRA

N71-16453# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
EFFECT OF DISSOLVED GASES ON CAVITATION IN LIQUIDS
Milton S. Plesset Oct. 1970 8 p refs
(Contract N00014-67-A-0094-0009)
(AD-713851; Rept-85-55) Avail: NTIS CSCL 20/4

When a liquid containing dissolved gas is subjected to the oscillating pressure of an acoustic wave, gas bubbles can form by the process of rectified diffusion. It is shown that the rate of rectified diffusion can be determined even when the diffusivity of the dissolved gas is not known since the diffusion coefficient can be related to the coefficient of viscosity of the liquid. The rate of rectified diffusion of argon in liquid sodium is evaluated in this way. Author (GRA)

N71-16469# Harry Diamond Labs., Washington, D.C.
A TECHNIQUE TO OBTAIN THE INPUT TO A FLUID TRANSMISSION LINE FROM MEASUREMENTS OF THE OUTPUT
Norman A. Eisenberg May 1970 32 p refs Sponsored by DASA
(AD-714200; HDL-TR-1499) Avail: NTIS CSCL 13/7

A linear analysis is performed that relates the input of a dispersive fluid transmission line to the transmission line characteristics and output of the line. The analysis produces an algorithm implemented in a computer program to compute input values from the measured output. The agreement between measured and calculated inputs to the transmission line is good. Author (TAB)

N71-16471# Ballistic Research Labs., Aberdeen Proving Ground, Md. Applied Mathematics Div.
SELF SIMILAR FLOW OUTSIDE AN EXPANDING SPHERE
Abdul R. Kiwan Sep. 1970 23 p refs
(AD-714197; BRL-1495) Avail: NTIS CSCL 20/4

Detailed properties of G. I. Taylor's similarity solution of a spherical air wave are investigated. An analytical process is used to locate the shock front. A fuller and more accurate table of results is given. Author (GRA)

N71-16478# Grumman Aerospace Corp., Bethpage, N.Y. Fluid Mechanics Section.
A COMPARISON OF THEORY AND EXPERIMENT FOR LAMINAR SEPARATION AHEAD OF A COMPRESSION CORNER AT SUPERSONIC AND LOW HYPERSONIC SPEEDS
William G. Hill, Jr. Dec. 1970 76 p refs

(RE-401) Avail: NTIS

The problem of two dimensional, supersonic flow separation ahead of a compression corner is investigated for the case of an initially laminar boundary layer. Results of many experimental investigations are restated in variables that allow comparison between the different sets of data, and are also used to test empirical correlations. Where possible, results of the available theoretical methods are compared with each other and with experiment. The theoretical methods studied are still quite complex and difficult to use and are limited to strictly two dimensional, fully laminar flow. While the flow in the vicinity of separation (free interaction region) is predicted by several methods. Author

N71-16483# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.

NONEQUILIBRIUM CORNER EXPANSION FLOW OF MOIST AIR

Leo T. Smith Oct. 1970 31 p refs

(Contract Nonr-609(47))

(AD-714210; Rept-20) Avail: NTIS CSCL 20/4

An experimental investigation of the nonequilibrium expansion flow of moist air around a sharp corner is reported. Heat addition within the expansion fan is accomplished by condensation by homogeneous nucleation of water vapor. Density measurements, obtained from flow interferograms, indicate that the flow field within the condensation zone depends on both expansion angle and radial distance from the corner. Measurements of the location of onset show that the leading edge of the condensation zone is concave with respect to the oncoming flow. An empirical relation between experimentally determined adiabatic supercooling and expansion cooling rate is obtained. Author (GRA)

N71-16484# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.

AN EXPERIMENTAL INVESTIGATION OF TWO-PHASE WEDGE FLOW

Leo T. Smith Oct. 1970 83 p refs

(Contract Nonr-609(47))

(AD-714209; Rept-19) Avail: NTIS CSCL 20/4

The flow of a two phase mixture of air and very small ice particles (approx. 100A) through an oblique shock wave, produced by a wedge, was studied experimentally and theoretically. Measurements of oblique shock angle and shock curvature, obtained from schlieren and shadow photographs, were used to determine initial particle evaporation rates behind the shock. Measured oblique shock angles are found to vary from the frozen angle at the leading edge of the wedge, to an equilibrium angle far from the leading edge. The experimental findings are in agreement with theoretical values computed for spherical particles evaporating in free molecular flow. Author (GRA)

N71-16491# Toronto Univ. (Ontario). Inst. for Aerospace Studies.

DIFFRACTION OF STRONG SHOCK WAVES BY A SHARP COMPRESSIVE CORNER

C. K. Law Jul. 1970 96 p refs

(Grant CONTR AF-AFOSR-1368-65)

(AD-714584; UTIAS-TN-150; AFOSR-70-0767TR) Avail: NTIS CSCL 20/4

The diffraction of strong shock waves in oxygen, in dissociation equilibrium, by a sharp compressive corner was investigated both theoretically and experimentally. The continuous curvature of the reflected shock wave R, for usual Mach reflection, changes when the pressure behind the bow shock generated by the wedge exceed that behind R. The appearance of a second triple shock system in irregular Mach reflection can be predicted from usual gasdynamic considerations without requirements from chemical kinetics. The location of the point where R kinks was also predicted. The above predictions are supported by the experimental results. The relative velocity between the first and second triple points can also be found, making it possible to do a useful analysis of conditions near the second triple point. Diffraction patterns for different gases (O2, N2, A and CO2) were investigated. An approximate solution was obtained from the first triple point trajectory angle as a function of incident shock Mach number and the wedge angle for dissociated oxygen. With the exception of small wedge angles and strong incident shocks, the agreement with experiment is good. Some reasons for the disagreement are given. An analysis was also made for oblique shock wave relations with imperfect gas effects (vibration and dissociation) including a two-shock confluence (regular reflection) and a three-shock confluence (Mach reflection). Author (GRA)

N71-16505*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EFFECT OF INJECTANT MOLECULAR WEIGHT ON MIXING OF A NORMAL JET IN A MACH 4 AIRSTREAM

Marvin G. Torrence Washington Jan. 1971 105 p

(NASA-TN-D-6061; L-6755) Avail: NTIS CSCL 20D

Experiments were conducted on mixing and penetration with normal injection in a supersonic airstream without chemical reaction. Molecular weight of the injected gases ranged from 2 (hydrogen) to 40 (argon). Pressure and mole fraction concentration surveys were made downstream of a sonic jet at axial stations as far as 200 jet orifice diameters. Jet-free-stream dynamic-pressure ratios were varied from 0.51 to 3.08. A nominal value of the free-stream Mach number was 4.03 with a corresponding Reynolds number per meter of 7.87 × 10 to the 7th power. The turbulent boundary layer on the flat-plate model had a thickness of approximately 3 jet orifice diameters. The decay of the maximum value of concentration with axial position was found to be a strong function of injectant molecular weight and the effect of molecular weight on vertical penetration was small. The rate of decay in the far field (downstream of the potential core) was similar for all injectants. Author

N71-16527*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COMPRESSIBLE FLOW ACROSS SHAFT FACE SEALS

John Zuk, Lawrence P. Ludwig, and Robert L. Johnson [1971] 44 p refs Proposed for presentation at 5th Intern. Conf. on Fluid Sealing, Coventry, Engl., 30 Mar.-2 Apr. 1971; sponsored by the Brit. Hydromech. Res. Assoc.

(NASA-TM-X-52959) Avail: NTIS CSCL 20D

An analysis is presented for compressible fluid flow across shaft face seals and narrow slots. The analysis includes fluid inertia, viscous friction and entrance losses. Subsonic and choked flow conditions can be predicted and analyzed. The model is valid for both laminar and turbulent flows. Results agree with experiment and with solutions which are more limited in applicability. Results show that a parallel film can have a positive film stiffness under choked flow conditions. Author

N71-16528*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF RANDOM FLUCTUATIONS IN PRESSURE GRADIENT ON CHANNEL FLOW

Morris Perlmutter [1971] 24 p refs Proposed for presentation at 1971 Flow Symp., Pittsburgh, 10-14 May 1971; sponsored by the Am. Inst. of Phys., ASME, Instr. Soc. of Am., and NBS

(NASA-TM-X-52980) Avail: NTIS CSCL 20D

A randomly fluctuating pressure gradient of a stationary Gaussian Markovian form will cause a randomly fluctuating velocity to be superimposed on the steady incompressible flow in a channel. Correlations, spectra, and frequency response functions for the random functions are given. Random pressure signals were generated using Fourier series expansion with coefficients randomly picked from distributions whose parameters were obtained from the spectra of pressure signal. The random velocity signals were then obtained from the pressure signal by use of the frequency response function calculated from the equation of motion. The increased power loss due to the fluctuations is given and the random pressure and velocity signals are compared for amplitude, frequency, and time lag. Author

N71-16529# Lockheed Missiles and Space Co., Palo Alto, Calif.
DYNAMIC BEHAVIOR OF LIQUIDS IN ELASTIC TANKS
Ghassan R. Khabbaz Aug. 1970 47 p refs
(LMSC-60-80-70-23) Avail: NTIS

The finite element procedure is used in conjunction with a simple source distribution of all surfaces of a liquid, which is contained in a tank of virtually arbitrary geometry, to obtain expressions for the mass and stiffness matrices of the liquid. The accuracy of the formulation is evaluated by the numerical solution of eigenvalue problems appropriate to simple rigid tanks for which analytical solutions are available. Once the mass and stiffness matrices of the liquid are obtained, they can be combined with those of an elastic tank to study the dynamic behavior of liquids in elastic tanks. Author

N71-16566# Naval Postgraduate School, Monterey, Calif. Dept. of Aeronautics.
THE APPLICATION OF HOLOGRAPHIC INTERFEROMETRY TO THE DETERMINATION OF ASYMMETRIC THREE-DIMENSIONAL DENSITY FIELDS IN FREE JET FLOW
Robert Dale Matulka (Ph.D. Thesis) Jun. 1970 155 p refs
(AD-714610) Avail: NTIS CSCL 20/4

The successful application of holographic interferometry, and an associated mathematical reduction process, to the determination of an asymmetric three-dimensional density field of an aerodynamic phenomenon is reported. An integral inversion method from the field of plasma physics was computerized, extensively evaluated and applied to the determination of functions, both axisymmetric and asymmetric, which simulate aerodynamic density fields. The application of holographic interferometry was extended to provide multiple holograms about a test region, with sufficient coverage to provide interferometric data for the successful solution of the density field. The analytical and experimental methods developed were applied to an experimental axisymmetric test field, the supersonic flow from a free jet, and shown to be comparable to a previous solution obtained by the Abel inversion method. Further, the free jet was tilted to provide a test field which was asymmetric in the plane of solution. Comparison of the resulting asymmetric solution was shown to be self-consistent with the previously obtained axisymmetric solution. Author (GRA)

N71-16586*# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
EXPERIMENTAL STUDY OF VISCOUS LOW-DENSITY NOZZLE FLOWS Final Report
Dietmar E. Rothe Jun. 1970 105 p refs
(Contract NASw-1668)
(NASA-CR-116247; CAL-AI-2590-A-2) Avail: NTIS CSCL 20D

An experimental investigation of the internal and external flow for nozzle Reynolds numbers in the general range between 100 and 1,000 with nitrogen as the test gas is presented. Electron-beam techniques are used for measuring gas density and rotational temperatures at selected points throughout the flow. Discharge coefficients are also measured. In addition, some effects of ambient pressure on the external flow structure are studied by flow visualization experiments. At the lower Reynolds numbers studied, experimentally determined temperatures indicate the existence of a supersonic bubble inside the nozzle expansion-cone, with a subsequent shock-free viscous transition to subsonic flow. These results substantiate the theoretical prediction of this phenomenon, first made by Rae in an earlier phase of this program. Author

N71-16587# Michigan State Univ., East Lansing. Div. of Engineering Research.
THE DEFINED REGION GEOMETRY FOR HIGH-GAIN PROPORTIONAL FLUID AMPLIFIERS Progress Report
J. F. Foss and S. J. Kleis 6 Jan. 1970 40 p refs
(Contract DAAG39-68-C-0034)
(AD-714654; PR-1) Avail: NTIS CSCL 13/7

Combined flow visualization and quantitative data for the defined region geometry are presented and interpreted. From these data, a flow model for the interaction region and some observations on the character of the resultant jet are presented. The flow model provides an explanation of the greater than ambient pocket pressure which allows this geometry to be used for a high-gain proportional amplifier. Author (GRA)

N71-16605# Advanced Technology Labs., Inc., Jericho, N.Y.
A DYNAMICAL MODEL OF FOG
Antonio Ferri, Paolo Baronti, and Sheldon Elzweig Sep. 1970 45 p refs
(Contract F44620-70-C-0007)
(AD-714625; ATL-TR-159; AFOSR-70-2292TR) Avail: NTIS CSCL 4/2

A model is presented to explain why fogs can be maintained for extended periods of time. The model considers the fog as a dynamical system whereby droplets depletion through fall is balanced by a continuous process of evaporation and condensation. The controlling parameters of the process are the heat transfer from the ground and the level of turbulence. The equations describing the system are presented and solved. Numerical examples are given and compared with experimental data. Author (GRA)

N71-16610# Aeronautical Research Associates of Princeton, Inc., N.J.
A PRELIMINARY EXPERIMENTAL STUDY OF THE BEHAVIOR OF DISTURBANCES INTRODUCED INTO A HIGHLY ACCELERATED LAMINAR BOUNDARY LAYER Final Report
Richard S. Snedeker, Coleman Du P. Donaldson, and John E. Yates Oct. 1970 46 p refs
(Contract AF 49(638)-1628)
(AD-714628; ARAP-152; AFOSR-70-2563TR) Avail: NTIS CSCL 20/4

An experimental study is described in which the effects of disturbances introduced into a highly accelerated, two-dimensional, laminar boundary layer were investigated. The disturbances were produced by a vibrating ribbon and the Reynolds number was in the range 400 - 1500. Small amplitude disturbances in the frequency range 10 - 150 Hz damped out quickly. For certain types of disturbances, apparent transition was observed even for values of the Reynolds number an order of magnitude below the minimum critical value given by classical theory. Tests were made to determine the nature of this transition, but no specific conclusion was developed on the basis of the available data. Comparison of measured and theoretical damping rates showed reasonable agreement for cases in which no transition occurred. The explanation of the observed effects, and the way in which the concepts of streamtube stretching under the influence of high acceleration is involved, requires further investigation. Author (GRA)

N71-16621# Michigan State Univ., East Lansing. Div. of Engineering Research.
THE INITIATION, DEVELOPMENT, AND DECAY OF THE SECONDARY FLOW IN AN INCOMPRESSIBLE TURBULENT BOUNDED JET Progress Report
J. F. Foss and J. D. Holdeman 30 Jun. 1970 396 p refs
(Contract DAAG39-68-C-0034)
(AD-714655; PR-2) Avail: NTIS CSCL 20/4

A comprehensive explanation of the initiation, development, and decay of the secondary flow in an incompressible turbulent bounded jet is presented and supported by experimental data. The planar vortex ring near the nozzle exit is stretched and reoriented resulting in the development of a large scale secondary flow. As the streamwise vorticity is diffused, the secondary motion decays. This explanation is supported by the vorticity and velocity data of this investigation. A measure of the vorticity near the nozzle exit was obtained with a four-blade vorticity meter. Isotachs and mass, momentum, and energy flux ratios were calculated from mean velocity measurements made at various elevations in a direction perpendicular to the streamwise direction of the flow.
Author (GRA)

N71-16650*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE INFLUENCE OF GAS VELOCITY ON THE BREAKDOWN POTENTIAL OF ARGON, HELIUM, AND NITROGEN
J. A. Gardner *In its* Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 177–182 (See N71-16631 06-09)
Avail: NTIS CSCL 20D

An experimental investigation was performed to determine the influence of gas velocity and pressure on the electrical breakdown potential of the gases between parallel plate electrodes and between concentric electrodes. A significant effect of gas velocity on the breakdown potential was observed during experiments with argon and helium flowing between parallel plate electrodes. This reduction in breakdown potential was also observed with argon flowing between concentric electrodes as shown with magnetoplasmadynamic arcs. The nitrogen data did not indicate the sudden decrease in breakdown potential. For parallel plate electrodes, the onset of breakdown appears to begin in the space between the electrode surfaces. After breakdown, the discharge column moves downstream to the trailing edge with the apparent velocity of the gas and deflects into a U-shaped configuration and remains attached to the trailing edges of the electrodes.
Author

N71-16662# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
TWO-PHASE FLOW AND HEAT TRANSFER IN MULTIROD GEOMETRIES Quarterly Progress Report, 1 Jan.–31 Mar. 1970
Apr. 1970 52 p refs
(Contract AT(03-4)-189)
(GEAP-10214; QPR-18) Avail: NTIS

A conductivity probe was used in the circular tube test section for flow regime observations, and for film thickness determination in the annular regime. Results show no evidence of slug flow right at the end of the heated length; instead, there is an extensive transition between the bubbly and annular regimes. In the range of parameters for the circular tube tests, slug flow occurs only under adiabatic conditions, and then only at the lower flows.
Author (NSA)

N71-16685*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AEROPHYSICS
In its Space Programs Sum. No. 37-65, Vol. 3, Aug.–Sep. 1970 31 Oct. 1970 p 156–157 refs (See N71-16671 06-30)
Copyright. Avail: NTIS CSCL 20D

Tests of supersonic boom pressures were made for a series of model configurations in the JPL 20-in. supersonic wind tunnel, which provides the flow characteristics required for good sonic boom studies. Mach number variation in the test rombus is 0.01 M and flow angularity has been found to be + or − 0.1 deg. Total pressure variation was less than 0.2% during the tests. Pressure data in the near-disturbance field of the test model were measured by a long slender static pressure probe mounted rigidly near the tunnel floor. The low differential pressure between the probe and a tunnel wall static pressure port were measured by a Barocell transducer and were recorded on a digital voltmeter. Models were mounted on a sting, and could be translated fore and aft over the probe to record the complete pressure signature.
Author

N71-16789# Sandia Corp., Albuquerque, N.Mex. Technical Translation Service.
FINITE DIFFERENCE EQUATIONS FOR CALCULATING THREE-DIMENSIONAL BOUNDARY LAYERS [DIFFERENZENFORMELN ZUR BERECHNUNG DREIDIMENSIONALER GRENZSCHICHTEN]
Egon Krause et al 21 Oct. 1970 113 p refs Transl. into ENGLISH of German report DLR-FB-69-66
(SC-T-70-4038; DLR-FB-69-66) Avail: NTIS

Difference equations for numerical integration of the equations of motion of three-dimensional laminar compressible boundary-layers are presented in this report. Detailed derivations are given for the matrix elements of the solution and for the recursion relations of the algorithm; three different difference schemes are considered. The decoupling of the momentum and energy equations from the continuity equation is described along with the iteration process of the solution. The truncation error and the stability of the difference equations are briefly discussed. These considerations are supplemented by detailed instructions about flow chart and listing of machine programme; two sample-calculations for purpose of checking are included.
Author (NSA)

N71-16800 Yale Univ., New Haven, Conn.
NONLINEAR EFFECTS IN A STEADY, INVISCID, AXISYMMETRICAL, NONEQUILIBRIUM FLOW
David Chung Chou (Ph.D. Thesis) 1969 70 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 70-2707

Presented is an analysis of the complete flow pattern of a supersonic, inviscid, nonequilibrium gas past any slender, axisymmetrical projectile. A combined use of the method of characteristic perturbation and the method of matched asymptotic expansion provides a uniform solution of the problem. Emphasis is placed on the prediction of attenuation of the frozen front shock-wave attached on the nose of a body in a relaxing medium. The analysis is found to agree well with the existing data from firing-range experiments in a known reacting mixture.
Dissert. Abstr.

N71-16852 Missouri Univ., Columbia.
AN INVESTIGATION OF THE SKEWED BOUNDARY-LAYER FLOW IN A CONVERGING CHANNEL
Thomas Harry Lindsey (Ph.D. Thesis) 1969 187 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 70-3001

Because of the curvature in the outer flow streamlines over a flat plate, there exist in the boundary-layer, pressure forces, which act normal to the flow toward the center of curvature. These pressure gradients cause the boundary-layer velocity vector to be skewed with respect to the main flow. The boundary-layer velocity vectors are no longer co-planar with the free stream velocity, U.

The skewed boundary-layer is generally considered in two components, the main-flow component in the direction of the free stream and the cross flow or secondary flow in a direction normal to the streamline. Experimentally investigated is this particular phenomena in a two-dimensional converging channel. Dissert. Abstr.

N71-16894* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VISCOUS-PENDULUM-DAMPER Patent
Wilmer H. Reed, III, inventor (to NASA) Issued 21 Mar. 1967 (Filed 26 Feb. 1965) 9 p Cl. 188-87
(NASA-Case-XLA-02079; US-Patent-3,310,138; US-Patent-Appl-SN-435756) Avail: US Patent Office CSCL 20D

A viscous pendulum damper having linear damping characteristics is described. The device was designed for bidirectional operation with precise regulation of damping for either tuned or untuned operation. By not requiring guy wires or external connections, the aerodynamic problems associated with spring mass dampers are avoided, and an inexpensive means of remotely controlled damping is provided. Operation of the device involves one or more modules made up of numerous interfitting trays filled with a viscous fluid to react against disc shaped slugs positioned on the trays. By altering the number of slugs, or by varying the pressure activating the mercury filled bellows, the damping characteristics are altered. D.L.G.

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N71-15725# Institut Royal Meteorologique de Belgique, Brussels.
GEOPHYSICAL OBSERVATIONS Monthly Bulletin, Mar. 1970 [OBSERVATIONS GEOPHYSIQUES Bulletin Mensuel, Mars 1970]
1970 41 p In FRENCH and DUTCH
Avail: NTIS

Geophysical data obtained at Dourbes (Belgium) relating to geomagnetism, air radioactivity, ionospheric parameters, seismology, cosmic rays, and atmospheric electricity during March 1970 are listed. ESRO

N71-15806# Institut Royal Meteorologique de Belgique, Brussels.
GEOPHYSICAL OBSERVATIONS Monthly Bulletin, Apr. 1970 [OBSERVATIONS GEOPHYSIQUES Bulletin Mensuel, Avril 1970]
1970 44 p In FRENCH and DUTCH
Avail: NTIS

Geophysical data obtained at Dourbes (Belgium) relating to geomagnetism, air radioactivity, ionospheric parameters, seismology, cosmic rays, and atmospheric electricity during April 1970 are listed. ESRO

N71-15841*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NIMBUS 3 SATELLITE OBSERVATIONS OF OZONE ASSOCIATED WITH THE EASTERLY JET STREAM OVER INDIA DURING THE 1969 SUMMER MONSOON
C. Prabhakara, V. V. Salomonson, B. J. Conrath, J. Steranka, and L. J. Allison Dec. 1970 26 p refs
(NASA-TM-X-65416; X-651-70-464) Avail: NTIS CSCL 04A

Global distribution of ozone is remotely sensed from the radiance measurements made by the infrared interferometer spectrometer on board the Nimbus 3 satellite. As ozone is a good tracer of the atmospheric motions in the lower stratosphere and upper troposphere, it is used to infer the nature of upper air currents over southeast Asia and Africa during June and July, 1969. Significant ozone minima over North India, and the deserts of Sahara and Middle East correspond to upper air high pressure systems over these regions. Ozone maxima are seen preferentially along the path of the strong easterly winds associated with the easterly tropical jet. These observations of atmospheric ozone demonstrate a potentially valuable way to follow the development of the southwest monsoon and the tropical easterly jet stream. Author

N71-15845# Environmental Research Corp., Las Vegas, Nev.
PHOTO INTERPRETATION OF CLOSE-IN PHYSICAL EFFECTS OF AN UNDERGROUND NUCLEAR DETONATION
Frank R. Perchalski Sep. 1970 14 p ref
(NVO-1163-TM-23) Avail: NTIS

Aerial photography provides a quick, economical and accurate technique for determining the surface changes caused by an underground nuclear detonation. Pre-shot and post-shot aerial photography was obtained for the Rulison detonation. These photographs were viewed stereoscopically to assess the surface changes associated with the Rulison detonation. The photo interpretation verified that no massive land slides or rock slides occurred as a result of the event. However, the interpretation revealed that 13 relatively small rock and soil movements occurred within 7 kilometers of ground zero. No information concerning physical effects beyond 7 kilometers is provided. Author (NSA)

N71-15846# California Univ., Livermore. Lawrence Radiation Lab.
MASS CONCENTRATIONS AND PARTICLE SIZE DISTRIBUTIONS AS A FUNCTION OF TIME WITHIN A NUCLEAR CRATERING CLOUD Final Report
Paul H. Gudiksen May 1970 20 p refs Sponsored in part by AEC
(NASA Order EO-807-69)
(UCRL-50844) Avail: NTIS

A detailed study was made of how the size distributions and mass concentrations of particles contained within a large atmospheric dust cloud generated by a nuclear cratering experiment vary with time during the first 4 hr after formation. Samples were collected between 12 min and 4 hr after cloud formation by filters on aircraft penetrating the cloud and by parachute-retarded samplers dropped through the cloud. These samples were analyzed for particle size distributions and mass concentrations, and a mathematical model was developed to account for the observed rate of change of these parameters. The model incorporates the effects of the atmospheric diffusion in three dimensions, gravitational settling of particles within discrete size groups, distortion of the cloud due to the vertical profile of the horizontal winds, and the deposition of the particles on the earth's surface. Author (NSA)

N71-15912# Environmental Research Corp., Las Vegas, Nev.
ANALYSIS OF THE APPLICABILITY OF EXISTING ANALYTIC MODELS FOR THE DESCRIPTION OF OBSERVED SEISMIC AMPLIFICATION EFFECTS
J. R. Murphy, N. L. Weaver, and G. B. Lamers Sep. 1970 103 p refs
(Contract AT(29-2)-1163)
(NVO-1163-211) Avail: NTIS

This report presents a comprehensive examination of the

amplification of ground motion by near-surface station geology from both the analytical and experimental viewpoints. The mathematical models available to describe amplification are presented and their limitations indicated. The geology of a number of Nevada Test Site seismic recording stations is described in detail and the quality of the available physical property data is assessed. A usable experimental amplification factor is defined in such a way that it is meaningful in terms of the available mathematical models. Experimental amplification factors are obtained for a wide variety of station geologies and ground motion intensities. The applicability of the various analytical models is tested using the observed amplification factors. The major conclusion is that the available mathematical models are generally adequate to describe the major features of the observed amplification for the station geologies investigated. Author (NSA)

N71-15920# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

EFFECT OF THERMAL GRADIENT ON IONIC DIFFUSION IN FROZEN EARTH MATERIALS. 2: THEORETICAL

Yoshisuke Nakano and Richard P. Murrmann Oct. 1970 40 p refs

(AD-714642; CRREL-RR-285) Avail: NTIS CSCL 8/13

The influence of a temperature gradient on the redistribution of chemicals by diffusion through thin films of interfacial water in frozen soil was predicted by two different methods. In one case, an exact solution of the diffusion equation with a distance-dependent diffusion coefficient was obtained. Secondly, a new approach based on the Monte Carlo method was developed. The advantage of the Monte Carlo method is that the dependence of the diffusion coefficient on distance may assume any functionality where one exponential form was used in obtaining the exact solution. The ionic concentration distributions computed using both approaches were in excellent agreement with experimental results. In all cases, the concentration distribution was virtually the same as that obtained in the absence of a thermal gradient, indicating that thermal gradients have little influence on the diffusion of ions in frozen soil. Author (GRA)

N71-15921# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

EFFECT OF THERMAL GRADIENT ON IONIC DIFFUSION IN FROZEN EARTH MATERIALS. 1: EXPERIMENTAL

Richard P. Murrmann and Pieter Hoekstra Sep. 1970 13 p refs

(AD-714644; CRREL RR-284) Avail: NTIS CSCL 8/13

Ionic concentration and water profiles in frozen bentonite samples subject to a thermal gradient of 0.3C/cm but different temperature intervals were obtained in the temperature range from 0C to -12C in order to determine the extent to which thermal gradients influence the movement of ions in thin films of interfacial water. The moisture content distribution was found to remain virtually unchanged after times ranging from 20 to 54 days, indicating that ionic movement was not affected by mass flow of mobile water in thin films. The ionic distribution profiles were essentially as expected in the absence of a temperature gradient. These observations support the conclusion that thermal gradients have little influence on redistribution of ions in frozen earth materials. Author (GRA)

N71-15937# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.

EXPERIMENTAL AND THEORETICAL STUDIES OF THE MECHANISM OF FROST HEAVING

Bruce Chalmers and Kenneth A. Jackson Oct. 1970 28 p

(Contract DA-19-016-eng-5745)

(AD-714641; CRREL-RR-199) Avail: NTIS CSCL 8/13

The paper discusses the Jackson and Chalmers theory of frost heave and describes attempts to verify it experimentally. The theory takes into account the local thermal conditions in the soil and the permeability of the soil. The theory predicts (or explains) stationary ice lens formation, where there is no advance of the frost line, and also predicts a rate of heave that is independent of the rate of advance of the freezing front. The theory assumes that a soil can be represented by a single characteristic void size although in real cases soils are not as uniform and homogeneous as assumed. Several experiments to verify the theory are described. They were generally unsuccessful, neither disproving nor substantiating the theory. Author (GRA)

N71-15987# Miami Univ., Fla. Battelle Memorial Inst., Columbus, Ohio. Rosenstiel School of Marine and Atmospheric Sciences.

REPORT ON THE MARINE FAUNA AND BENTHIC SHELF-SLOPE COMMUNITIES OF THE ISTHMIAN REGION Bioenvironmental and Radiological-Safety Feasibility Studies, Atlantic-Pacific Interoceanic Canal

Frederick M. Bayer, Gilbert L. Voss, and C. Richard Robins 6 Feb. 1970 488 p refs Prepared for Battelle Memorial Inst., Columbus, Ohio.

(Contract AT(26-1)-171)

(BMI-171-38) Avail: NTIS

The construction of a proposed sea-level canal across the Isthmus of Panama could possibly unite the fauna and flora of the Caribbean Sea and the Pacific Ocean by allowing free passage of eggs, larvae, and adults through the canal. It was thought that this might have deleterious effects on one or both faunas. Large collections of invertebrates and fishes from these areas were made. Investigations consisted of taxonomic identifications, computer analysis of the distributions of species to reveal natural communities, analysis of results, and literature surveys. A summary of the geological and paleontological history of the isthmus and its fauna was also undertaken. NSA

N71-16027*# Pittsburgh Univ., Pa. Dept. of Physics.

THE POLAR ION FLOW: WIND OR BREEZE ?

T. M. Donahue 23 Oct. 1970 19 p refs

(Grants NsG-416; NSF GA-1237)

(NASA-CR-116139; SRCC-142) Avail: NTIS CSCL 04A

Hydrodynamic and evaporative theories of light ion flow from the polar cap are reviewed. Both types of theories should be able to provide correct treatments of the phenomenon. Some difficulties with the hydrodynamic theory are mainly interpretative and should disappear if the so called pressure gradient force term in the equations of motion is recognized as really inertial in nature. An important new insight was provided recently in an evaporative theory by the realization that the electric field in the exosphere required to balance electron and ion fluxes is quite different from the electric field of gravitational separation usually used in ionospheric theory. However, an evaporative theory that is based on realistic boundary conditions as well as an acceptable electric field remains to be worked out. The actual situation in the polar ionosphere is sufficiently complex that experimental studies will undoubtedly be needed to establish the actual conditions which exist there. Author

N71-16107# New York Univ., N.Y. Geophysical Sciences Lab.

SOME ASPECTS OF THE NEW YORK UNIVERSITY MATHEMATICAL MODEL OF THE OCEAN FOR OCEANOGRAPHIC FORECASTING

Akira Okubo Oct. 1970 63 p refs

(Contract Nonr-285(57))

(AD-714507; GSL-TR-70-13) Avail: NTIS CSCL 8/3

A working numerical model for oceanographic forecasting

is being developed at the Department of Meteorology and Oceanography, New York University. In this paper we discuss a few aspects of physical problems in the basic model equations and boundary conditions. These are (1) realistic initial conditions which enable the forecasting model to track rapidly variable wind stresses and water properties imposed at the sea surface, (2) nonlinear eddy fluxes in the vertical direction, and (3) boundary mixing at lateral and bottom walls. In Problem (1), use is made of the results on theoretical models for the thermohaline circulation of the oceans to construct the realistic initial conditions. Thus the velocity and density fields are expressed by similarity forms that are valid in the interior of the ocean. In Problem (2), the dependence of the vertical eddy conductivity on water stratification is taken into account in the vertical flux of heat. The resultant diffusion process may describe realistic temperature profiles in the surface layer for a warming period. In Problem (3), two kinds of boundary mixing processes are studied. Author (GRA)

N71-16126*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

EARTH RESOURCES AIRCRAFT PROGRAM STATUS REVIEW. VOLUME 1: GEOLOGY, GEOGRAPHY, AND SENSOR STUDIES

1968 571 p refs Conf. held at Houston, Tex., 16–18 Sep. 1968

(NASA-TM-X-62564) Avail: NTIS CSCL 08F

Reviewed are the various aspects of aerial remote sensors and multispectral imagery of the Earth Resources Program as applied to the areas of geology, geography, and urban planning. Emphasized imaging systems constitute black and white photography, color photography, infrared imagery, and radar imagery. For individual titles, see N71-16127 through N71-16146.

N71-16127*# Geological Survey, Washington, D.C.

MISSION 73 AND ASSOCIATED TESTS

Robert H. Alexander *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 1 1968 33 p ref (See N71-16126 06-13)

Avail: NTIS CSCL 08F

Results from multisensor remote aerial imaging experiments in southern California established that: (1) Hasselblad cameras with color infrared films are superior to other cameras for land-use identification; (2) calibrated scanning microwave radiometers are applicable in soil moisture determinations but should be correlated with point measurements on the ground; (3) infrared radiometers are suitable for quantitative temperature measurements over urban areas; and (4) scanning microwave radiometers can record areas of wind disturbance and hence horizontal energy transfers over bodies of open water. G.G.

N71-16128*# California Univ., Riverside. Dept. of Geography.

SOUTHERN CALIFORNIA REGIONAL RESOURCES STUDIES

Leonard W. Bowden *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 1 1968 29 p refs (See N71-16126 06-13)

Avail: NTIS CSCL 08F

Objectives of described tests were to correlate multisensor and ground-truth observations in order to evaluate the feasibility of sensors and sensor combinations as data gathering components of aircraft in the following areas: (1) land use; (2) urban problems; (3) surface energy balance; (4) soil moisture; (5) vegetation mapping; and (6) air pollution analysis. Summary evaluations of each sensor are given. Utilized were Ektachrome IR 8443 imagery, side-looking airborne radar, multiband photography, thermal infrared imagery, telescopic systems, and imaging passive microwave devices. G.G.

N71-16129*# East Tennessee State Univ., Johnson City.

LAND USE AND REGIONAL ANALYSIS

Robert W. Peplies *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 1 1968 21 p refs (See N71-16126 06-13)

Avail: NTIS CSCL 08F

Results from five remote sensing overflights of a test site indicated the following: (1) color infrared photographs appear to be superior to Ektachrome and panchromatic photos for interpretation of rural land-use features; (2) radar image interpretations can be used to characterize areas in integrated landscapes; (3) radar images are useful for mapping linear features of topographic surfaces; (4) remote sensor imagery can determine trade areas and traffic flow; observations include black and white panchromatic, color, and color infrared films; (5) color and color infrared films can be utilized in pond and lake studies if the parameters that affect the variations of color on the film are controlled; (6) large scale infrared and color photographs identify slope failure forms; and (7) remote sensor data can be applied to urban and regional transportational and land-use planning. G.G.

N71-16130*# Georgia Univ., Athens.

REMOTE SENSING OF FIRE PHENOMENA IN TROPICAL GRASSLANDS: THE FLORIDA TEST SITES, 1967–1968

Merle C. Prunty *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 1 1968 11 p refs (See N71-16126 06-13)

Avail: NTIS CSCL 08F

Modifications in vegetative cover caused by ground fires were recorded during overflights at differing heights by remote color infrared imagery and compared with ground control mappings. It was found that recognition and distribution of ground fire areas was accurately determined even on sites with dense forest covers; results from 15,000-feet height infrared film were virtually identical to those from exposures at 3000 feet. G.G.

N71-16131*# Northwestern Univ., Evanston, Ill. Dept. of Geography.

REMOTE SENSING AND THE STUDY AND PLANNING OF URBAN AREAS

Duane F. Marble and Frank E. Norton (Iowa Univ.) *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 1 1968 13 p refs (See N71-16126 06-13)

Avail: NTIS CSCL 08F

The application of aerial sensor technology to the identification of urban problems and urban planning is considered. Side-looking radar, thermal infrared scanners, and hyperaltitude photography are potential urban data sources for measuring the quality of residential environment from photographic images. A standard long-focal-length mapping camera placed on a satellite during earth orbit can be used to generate additional data points in low altitude aircraft imagery. G.G.

N71-16132*# Kansas Univ., Lawrence. Dept. of Geography.

THEMATIC LAND-USE MAPPING WITH SPACECRAFT PHOTOGRAPHY AND RADAR

David S. Simonett *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 1 1968 24 p refs (See N71-16126 06-13)

Avail: NTIS CSCL 08B

Construction of thematic maps with spacecraft-derived photographs and with radar images obtained from aircraft with resolutions comparable to those anticipated from spacecraft is in progress. Preliminary studies are reported in a discussion of: (1) whether existing thematic land-use maps could be constructed with space data; (2) problems of constructing thematic land-use maps

using space data; (3) information in Gemini photographs and in aircraft radar images; and (4) some aspects of the roles of photography and radar as complementary and supplementary sensors. Author

N71-16134*# Geological Survey, Washington, D.C.
INFRARED SURVEY OF THE PISGAH CRATER AREA, SAN BERNARDINO COUNTY, CALIFORNIA: A GEOLOGIC INTERPRETATION
Stephen J. Gawarecki *In* NASA. Manned Spacecraft Center Earth Resouces Aircraft Program Status Rev., Vol. 1 1968 38 p refs (See N71-16126 06-13)
(NASA Order R-148)
Avail: NTIS CSCL 08F

Infrared imagery in the 8 micron to 14 micron band of the Pisgah Crater area, California, has provided useful geologic information to complement data obtained from ground studies and from aerial photography. Thermal contrasts representative of those found through the diurnal cycle were acquired. Among the geologic features shown on the imagery of one or more flight periods were basalt flow contacts where the adjacent flows differed in surface character, distribution of pyroclastics and their alluvial derivatives on the flows, collapsed lava tubes, fissured areas, detail of the Pisgah fault, zonation within Lavic Dry Lake, active drainage on an alluvial fan, and moist areas suggestive of ground-water conditions. Author

N71-16135*# Geological Survey, Washington, D.C.
THERMAL ANOMALIES AND GEOLOGIC FEATURES OF THE MONO LAKE AREA, CALIFORNIA, AS REVEALED BY INFRARED IMAGERY
Jules D. Friedman *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 1 1968 76 p refs (See N71-16126 06-13)
Avail: NTIS CSCL 08F

The Mono Lake area, California, was selected for airborne infrared scanning radiometer experiments because of the exposure in this area of a variety of lithologies having different physical and thermal properties, as well as a diversity of textural and morphologic features. The contrasting thermal patterns observed can be grouped as follows: (1) thermal anomalies caused by convective heat loss detected when the temperature difference between the heat source and surrounding terrain was maximal; (2) daytime radiant-temperature differences resulting from variations in the incident radiant solar flux as a function of microrelief and morphology of the surface; and (3) nighttime radiant-temperature differences resulting from contrasts in physical and thermal properties of various lithologic units and water. Author

N71-16136*# Geological Survey, Washington, D.C.
GEOLOGIC EVALUATION OF THERMAL INFRARED IMAGERY, CALIENTE AND TEMBLOR RANGES, SOUTHERN CALIFORNIA
Edward W. Wolfe *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 1 1968 27 p refs (See N71-16126 06-13)
Avail: NTIS CSCL 08F

Thermal infrared imagery obtained in southern California in the pre-dawn and postsunrise hours leads to the following conclusions: (1) the specific gravities of surficial materials influence tonal densities in predawn infrared imagery; (2) geologic interpretation of tonal density patterns is complicated by topographic, atmospheric, and vegetative effects on predawn radiation; (3) geologic features, such as outcrop patterns and some faults, are recognizable in the infrared imagery, as well as in aerial photographs; (4) local radiative anomalies, previously suggested to be caused by the occurrence of groundwater at shallow depths, may be caused by nighttime entrapment of cold iar in poorly drained, topographically low areas, and (5) postsunrise infrared imagery is dominated by the perferential warming of slopes exposed to the early morning sun and resembles low-sun-angle photographs. Author

N71-16137*# Geological Survey, Flagstaff, Ariz.
RADAR AND INFRARED IN GEOLOGICAL STUDIES OF NORTHERN ARIZONA
Gerald G. Schaber *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 1 1968 29 p refs (See N71-16126 06-13)
Avail: NTIS CSCL 08F

Airborne remote radar and infrared sensing data of northern Arizona are summarized and evaluated. Radar imagery furnished useful data in interpretation of tectonics, surface moisture, and overlapping sequences of lava flows. Infrared scanner data provided identification of prehistorical agricultural sites and discrimination between recent dark volcanic ash and lighter, older ash-fall deposits as a function of radiant temperature and possible moisture content. Both sensors did not provide distinctions between rock types. G.G.

N71-16138*# Kansas Univ., Lawrence. Center for Research in Engineering Science.
PLUSES AND MINUSES OF RADAR IN GEOLOGICAL EXPLORATION
L. F. Dellwig *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 1 1968 42 p refs (See N71-16126 06-13)
Avail: NTIS CSCL 08G

Aerial radar imagery for geological explorations presents a topography where gross structural and topographic relationships integrate integral and independent features into a regional format; thus, radar is the best sensor for detection, integration, and analysis of lineaments. Its value decreases in small scale studies where polarization and wavelength are of greater significance to detailed geology. G.G.

N71-16139*# Geological Survey, Denver, Colo.
PROGRAM STATEMENT FOR REGIONAL GEOLOGIC STUDIES IN REMOTE SENSING, YELLOWSTONE NATIONAL PARK
Harry W. Smedes *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 1 1968 9 p refs (See N71-16126 06-13)
Avail: NTIS CSCL 08F

Remote aerial sensing data obtained by side-looking radar, infrared color photography, ultraviolet scanner, and multiple channel scanner spectrometer are analyzed. It was found that radar images provide good distinctions between bedrock and unconsolidated surface geology. Infrared imagery detected cold energing springs and traced a fault beneath a lake. The radar image texture made it possible to differentiate between principle areas of rhyolite lava and of rhyolite ash flows. Radar and infrared imagery together provided a good representation of the geological physiography but did not distinguish between rock types and structures. G.G.

N71-16140*# Geological Survey, Manlo Park, Calif.
GEOTHERMAL INFRARED ANOMALIES OF LOW INTENSITY, YELLOWSTONE NATIONAL PARK
Donald E. White and Lee D. Miller *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 1 1968 4 p Prepared in cooperation with Colorsdo State Univ.

(See N71-16126 06-13)
Avail: NTIS CSCL 08F

Infrared remote sensing of hot springs and other high temperature geothermal phenomena is described. A combination of vertical color photographs, heat flow maps, infrared scanner imagery, apparent surface temperatures, and different temperature interval images was computer evaluated in order to establish the thermal anomalies. Evidence for concealed geothermal reservoirs are temperature gradients and heat flows three to 10 times higher than worldwide averages. G.G.

N71-16141*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

RADAR AND INFRARED IMAGERY, OREGON AND WASHINGTON COASTS

Norman S. MacLeod and Parke D. Snavely, Jr. *In its* Earth Resources Aircraft Program Status Rev., Vol. 1 1968 8 p (See N71-16126 06-13)
Avail: NTIS CSCL 08F

Radar and infrared imagery were used to study the geology of coastal Oregon and Washington. Obtained side-looking radar imagery mappings established topographic expressions of lithologic and structural features including the extension of a large geological fault. Infrared aerial imagery provided current patterns in offshore waters, a fault as a faint thermal lineation caused by water seepage, large-scale sand waves in tidal flats, and extensions of fresh water plums seaward from the mouths of several rivers. G.G.

N71-16142*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

PROGRESS IN APPLICATION OF REMOTE-SENSING TECHNIQUES TO MARINE GEOLOGY AND HYDROLOGY

Ernest H. Lathram *In its* Earth Resources Aircraft Program Status Rev., Vol. 1 1968 2 p (See N71-16126 06-13)
Avail: NTIS CSCL 08J

Aerial infrared imagery and radiometer surveys, together with geochemical sampling of the water column and bottom sediments established the abundance of most major and minor ions in four cross sections of the San Francisco Bay. Color photograph interpretations of the Texas coastal area revealed that washover scars caused by hurricanes recurred in the same places and that an island dune field migrated westward. G.G.

N71-16143*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

AIRBORNE MULTIFREQUENCY MICROWAVE RADIOMETRIC SENSING OF AN EXPOSED VOLCANIC PROVINCE

John C. Blinn, III, Peter Chapman (Nevada Univ.), and Jack Quade (Nevada Univ.) *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 1 1968 54 p refs Submitted for publication (See N71-16126 06-13)
(JPL-TM-33-405) Avail: NTIS CSCL 08F

An empirical study was conducted, using airborne and ground-based sensors, to search for correlations between multispectral microwave brightness temperatures and geologic parameters. The test site was chosen because of its simple topography, large distinct areas of homogeneous composition, roughness characteristics, and lack of vegetation. Radiometers, operating at 9.3, 15.8, 22.2, and 34.0 gigahertz, were flown over preselected flight lines four times per flight to collect data. Results of the ground-truth studies and analysis of the aircraft overflights show a distinction between cinder and lava, two chemically similar materials with different surface characteristics. Results from an area of cinder layered over lava show a distinctive response, which may be related to cinder thickness. Author

N71-16144*# Geological Survey, Washington, D.C.

APPLICATION OF ULTRAVIOLET REFLECTANCE AND STIMULATED LUMINESCENCE TO THE REMOTE DETECTION OF NATURAL MATERIALS

William R. Hemphill *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 1968 22 p refs Presented at the 1968 Am. Soc. of Photogrammetry Conv., Washington, D.C., 11–15 Mar. 1968 (See N71-16126 06-13)
Avail: NTIS CSCL 08G

Outdoor tests of an active ultraviolet imaging system have demonstrated the feasibility of imaging ultraviolet-stimulated luminescence of such minerals as talc, dolomite, and dewelyite along quarry faces from distances of several hundred feet. The system features a cathode-ray-tube transmitter, an image-dissector receiver, and a video monitor on which the distribution of luminescent materials is imaged as the out-crop is scanned. A pulsed ultraviolet laser emitting at 3371 angstroms has been used successfully in the laboratory to stimulate phosphorescence of selected rock and mineral specimens and to discriminate between them on the basis of decay time, which ranges from less than 3 to more than 10 microseconds. Initial results suggest that sodic feldspars have longer decay periods than calcic feldspars. Some granites also appear to have decay periods significantly different from other types of granite in the same locality. Author

N71-16145*# Kansas Univ., Lawrence. Center for Research in Engineering Science.

RADAR PROGRESS IN THE NASA EARTH RESOURCES AIRCRAFT PROGRAM

R. K. Moore *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 1 1968 51 p refs (See N71-16126 06-13)
Avail: NTIS CSCL 08F

Design and performance of a 13.3-gigahertz scatterometer for measuring radar differential scattering coefficients is described and its application, together with an imaging radar for aerial sea-state measurements is outlined. The sea-state measurements provide a complete curve of scattering coefficient versus angle for each patch of sea relative independent of frequency for radar sea returns. Combined used of multifrequency radar scatterometers and imagers gives feasible frequency signature in the radar region. The processing of multispectral image data by computer is advocated and a real-time image discrimation enhancement and combination system is depicted. G.G.

N71-16147*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

EARTH RESOURCES AIRCRAFT PROGRAM STATUS REVIEW. VOLUME 2: AGRICULTURE, FORESTRY, AND SENSOR STUDIES

1968 452 p refs Conf. held at Houston, Tex., 16–18 Sep. 1968
(NASA-TM-X-62565) Avail: NTIS CSCL 08F

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Res. Ser., Weslaco, Tex.) 9 p refs (See N71-16151 06-04)

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12. DETECTION OF FOREST INSECT OUTBREAKS BY REMOTE SENSING R. C. Heller (Agriculture Dept., Berkeley, Calif.) 62 p refs (See N71-16159 06-04)

13. THE IDENTIFICATION OF WESTERN FOREST SPECIES BY MEANS OF REMOTE SENSING D. T. Lauer (Calif. Univ., Berkeley) 16 p (See N71-16160 06-04)

14. REMOTE-SENSING APPLICATIONS FOR THE INVENTORY OF RANGE RESOURCES D. M. Carneggie (Calif. Univ., Berkeley) 27 p (See N71-16161 06-13)

15. THE FEASIBILITY OF INVENTORYING NATIVE VEGETATION AND RELATED RESOURCES FROM SPACE PHOTOGRAPHY C. E. Poulton (Oregon State Univ.) 24 p refs (See N71-16162 06-13)

16. RESULTS OF EARTH RESOURCE INVESTIGATIONS M. R. Holter (Michigan Univ., Ann Arbor) 21 p (See N71-16163 06-13)

17. RADAR PROGRESS IN THE NASA EARTH RESOURCES AIRCRAFT PROGRAM R. K. Moore (Kansas Univ., Lawrence) 51 p (See N71-16164 06-07)

18. INFRARED STUDIES D. S. Lowe (Michigan Univ., Ann Arbor) 17 p (See N71-16165 06-14)

N71-16149*# Department of Agriculture, Washington, D.C.

INTEGRATION OF DETAILED LABORATORY AND FIELD STUDIES WITH THE AIRCRAFT PROGRAM

Victor I. Myers and Ross W. Leamer *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 2 1968 22 p (See N71-16147 06-13)

Avail: NTIS CSCL 08H

In determining plant and soil signatures, certain characteristics of color transparencies have not been fully exploited. Extraction of hue, value, and chroma can yield signatures of earth resources with tremendous potential for identifying earth objects from spacecraft or aircraft. Apollo 502 and NASA aircraft mission 75 color photography were subjected to spectrophotometric analysis to extract signatures of earth objects. Results showed that there was a substantial effect of sun elevation (time of day) on total illumination and shading of exposed soil. The combination of microdensitometer and statistical procedures employed in this study should greatly enhance the opportunity for intelligent interpretation of aircraft and spacecraft photography. A.L.

N71-16150*# Agricultural Research Service, Weslaco, Tex.

CROP AND SOIL IDENTIFICATION FROM AERIAL PHOTOGRAPHS

R. W. Leamer and D. A. Weber *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 2 1968 4 p (See N71-16147 06-13)

Avail: NTIS CSCL 08H

Results of preliminary examinations of aerial photographs taken in midsummer 1968 at Weslaco, Texas are summarized. These photographs were analyzed in an effort to determine if crop and solid identifications could be made for photographic imagery. Measurement and interpretation of photographic film at Weslaco is being automated by use of a isodensitracer with a digital encoder, and a paper tape punch attachment. A.L.

N71-16154*# Purdue Univ., Lafayette, Ind. Lab. for Agricultural Remote Sensing.

DATA PROCESSING PROGRAMS AT LARS-PURDUE

D. A. Landgrebe *In* NASA. Mannes Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 2 1968 24 p (See N71-16147 06-13)

Avail: NTIS CSCL 08F

A primary mission of the data processing programs group, working in concert with the other four Laboratory for Agricultural Remote Sensing program areas, is to establish the existence of uniquely characteristic earth surface features of importance of agriculture. Initial efforts have concentrated on developing such a capability for the identification and measurement of important crop types in temperate zones. Other identification tasks of economic importance include soil mapping, identification of water bodies, detection of stressed vegetation conditions, and general landscape mapping. Feasibility studies to date indicate that the most promising set of characterizing features include stable, precise measurements of radiance of each scene-resolution element simultaneously in multiple wavelength bands. Author

N71-16155*# Purdue Univ., Lafayette, Ind. Lab. for Agricultural Remote Sensing.

PHYSICAL MEASUREMENTS PROGRAMS AT LARS-PURDUE

Roger A. Holmes *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 2 1968 24 p refs (See N71-16147 06-13)

Avail: NTIS CSCL 08F

The Laboratory for Agricultural Remote Sensing (LARS) physical measurements group has the general responsibility for the conception, experimental design, calibration, and operation of instruments for the measurement of physical observables of the natural environment. The scope of the measurements program includes laboratory, field, aircraft, and satellite experiments seeking to define, measure, and utilize electromagnetic radiation phenomena in timely quantitative identity of agricultural and vegetative conditions. Author

N71-16157*# California Univ., Berkeley. School of Forestry and Conservation.

WILDLAND RESOURCE INVENTORIES UNDER THE NASA EARTH RESOURCES SURVEY PROGRAM

William C. Draeger *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 2 1968 10 p (See N71-16147 06-13)

Avail: NTIS CSCL 08F

Most of the NASA sponsored research concerned with wildland resource inventories has been centered in the Bucks Lake Test Site in the Sierra Nevada Mountains of California. Emphasis has been placed on the wildland vegetation resources in this primarily forested area. One research objective has been to define the optimum image specifications for inventorying the various vegetation types and other wildland resources on small scale imagery. From an interpretation of such imagery, the feasibility of identifying representative resource features in the Bucks Lake Test Site has been determined. Author

N71-16161*# California Univ., Berkeley. School of Forestry and Conservation.
REMOTE-SENSING APPLICATIONS FOR THE INVENTORY OF RANGE RESOURCES
David M. Carneggie *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 2 1968 27 p (See N71-16147 06-13)
Avail: NTIS CSCL 06C

Department of Agriculture–NASA sponsored research which investigates the feasibility of applying remote sensing, either from aircraft or spacecraft, as a tool for the inventory and management of range resources is summarized. Primary concern was focused upon: (1) the results from analyses of remote sensing data procured by NASA–Houston aircraft; (2) applications and possible benefits to accrue from remote sensing; and (3) relationships between aircraft-program and space-obtained remote sensing data. Author

N71-16162*# Oregon State Univ., Corvallis.
THE FEASIBILITY OF INVENTORYING NATIVE VEGETATION AND RELATED RESOURCES FROM SPACE PHOTOGRAPHY
Charles E. Poulton *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 2 1968 24 p refs (See N71-16147 06-13)
Avail: NTIS CSCL 06C

Utilizing data acquired from NASA aircraft and Gemini 4 photography, the investigation is attempting to: (1) determine the potentialities and limitations of mapping and interpreting characteristics of native vegetation areas from space photography; (2) compare vegetation maps prepared from this photography with other available vegetation-resource maps; and (3) identify problems and limitations in the practical use of space photography in earth resources applications. Progress achieved on this investigation is summarized. A.L.

N71-16163*# Michigan Univ., Ann Arbor.
RESULTS OF EARTH RESOURCE INVESTIGATIONS
Marvin R. Holter *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 2 1968 21 p (See N71-16147 06-13)
Avail: NTIS CSCL 08F

Research at the University of Michigan under the Earth Resources Program is focused on the problems of data processing/interpretation/utilization for agricultural purposes. Imagery and discrimination results for data obtained at an agricultural test site are presented and discussed. Aerial photography and scanner data, and ground data and measurements are presented. Results demonstrate great progress in discrimination over current operational aerial survey techniques. A.L.

N71-16166*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
EARTH RESOURCES AIRCRAFT PROGRAM STATUS REVIEW. VOLUME 3: HYDROLOGY, OCEANOGRAPHY, AND SENSOR STUDIES
1968 421 p refs Conf. held at Houston, Tex., 16–18 Sep. 1968 (NASA-TM-X-62566) Avail: NTIS CSCL 08F

A review of the various aspects of the Earth Resources Program, divided into geology, geography, hydrology, agriculture and forestry, and oceanography, is presented. Information is presented on the current status of continuing programs, with emphasis on remote sensor applications in hydrology and oceanography. For individual titles, see N71-16167 through N71-16186.

N71-16167*# Geological Survey, Tacoma, Wash.
EVALUATION OF SOUTH CASCADE GLACIER TEST SITE RESULTS
M. F. Meier *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 3 1968 17 p refs (See N71-16166 06-13)
Avail: NTIS CSCL 08F

Remote sensor studies were carried out to determine the best methods for detecting the presence or absence of snow and ice and the preciseness with which the surface temperature can be measured, to differentiate the type of material, to measure the thickness, density, and liquid water content of snow, and to determine the effects of time of day, weather, and terrain on the measurement results. The various techniques used in the studies are described. R.B.

N71-16168*# Geological Survey, Arlington, Va.
EFFECTS OF URBAN DEVELOPMENT ON THE HYDROLOGY OF LONG ISLAND, NEW YORK
E. J. Pluhowski *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 3 1968 9 p (See N71-16166 06-13)
Avail: NTIS CSCL 08F

The use of infrared imagery to detect changes in the thermal patterns of water bodies and nearby land areas, induced by urban development, is discussed. Analysis of the imagery is presented for wavelengths from 8 to 14 microns. R.B.

N71-16169*# Geological Survey, Washington, D.C.
APPLICATION OF REMOTE SENSING TO OCCURRENCE OF COLLAPSE SINKHOLES IN THE ALAFIA AND PEACE RIVER BASINS, FLORIDA
A. E. Coker *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 3 1968 13 p refs (See N71-16166 06-13)
Avail: NTIS CSCL 08F

Techniques are discussed by which sinkhole collapse may be anticipated by using remote sensors to identify, delineate, and study relic features in relation to sinkhole collapse. The recorded data show a correlation between the water level and the aquifer and collapse. The relationship of sinkhole collapse to water resources is considered. R.B.

N71-16170*# Geological Survey, Washington, D.C.
USE OF REMOTE SENSORS IN CLASSIFYING LAKES IN WEST-CENTRAL FLORIDA
J. W. Stewart *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 3 1968 11 p ref (See N71-16166 06-13)
Avail: NTIS CSCL 08F

The application of remote sensors to problems of lake hydrology is discussed with respect to the optimum parameters that can be used: (1) for establishing a system of classification of lakes in a karst topography, (2) developing a classification of the shoreline features of lakes to establish average high-water marks historically significant to the hydrology of the area, and (3) determining the interrelations between different classes of lakes and their occurrence and effects on the hydrological regime of an area. Author

N71-16171*# Geological Survey, Miami, Fla. Water Resources Div.
REMOTE-SENSING APPLICATIONS TO HYDROBIOLOGY IN SOUTH FLORIDA
Milton C. Kolipinski and Aaron L. Higer *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 3 1968 43 p refs (See N71-16166 06-13)
Avail: NTIS CSCL 08F

Results are presented of a continuing effort in the application of remote-sensing data as a tool in hydrobiological investigations in

the Everglades and coastal regions of south Florida. Panchromatic, color, color infrared, and multiband photographs used individually and in combination show gross, as well as detailed, features that permit evaluation of water resources. Hydrologic features such as depth and size of the basins and drainage patterns are easily measured or observed from the photographs. The distribution of aquatic and semiaquatic plants serves as an indicator of hydrologic conditions. Examples are the occurrence of red and black mangrove trees along the tropical shorelines of Florida, which would indicate the mean high-water level; also, the particular reflections on photographs from algal mats and emergent aquatic plants allow for the delineation of the fresh-water/brackish-water interface. These observations were made even from orbital photography at an altitude greater than 150 miles. Multiband imagery shows potential in extracting the spectral signatures of willow and fig trees and cattail marshes in the Everglades. The findings have transfer value to other marsh, swamp, and coastal regions of the United States.
Author

N71-16172*# Geological Survey, Philadelphia, Pa.
ESTUARINE STUDIES
Richard W. Paulson *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 3 1968 10 p (See N71-16166 06-13)
Avail: NTIS CSCL 08F

The objective of the estuarine remote-sensing program is to determine the feasibility of using remote sensors for studying estuaries from aircraft or spacecraft platforms. The particular objectives of the Delaware Estuary Program are to determine whether variations in water quality, which are known to exist in this highly polluted water body, can be detected remotely and to devise methods for using remote-sensing data to solve estuarine problems.
Author

N71-16173*# Geological Survey, Towson, Md.
USE OF INFRARED IMAGERY TO LOCATE SURFICIAL AQUIFERS, DELMARVA PENINSULA, MARYLAND AND DELAWARE
Este F. Hollyday *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 3 1968 14 p refs (See N71-16166 06-13)
Avail: NTIS CSCL 08F

Infrared imagery was tested as a rapid reconnaissance technique for locating the thickest sections of water-bearing surficial sand in order to augment a conceptual hydrogeologic framework that will facilitate orderly development and management of water supplies. Imagery obtained from NASA aircraft overflights in July 1967 and January 1968 recorded the relative temperature of visible water along a control line, where the hydrogeology had been studied in detail, and along six test lines. Data were analyzed by noting all parts of surface-water bodies that appeared to have pronounced anomalous temperatures. The location of the three strongest and most diffuse thermal anomalies seemed to be controlled by the following hydrogeologic constraints: (1) areas of thick surficial sands, (2) short reaches of major streams almost immediately above the head of estuaries, and (3) the absence of fine-grained marine sediments overlying the surficial sand aquifers.
Author

N71-16174*# Geological Survey, Washington, D.C.
REMOTE SENSING OF MARSHLANDS AND ESTUARIES USING COLOR INFRARED PHOTOGRAPHY
Richard R. Anderson *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 3 1968 23 p refs (See N71-16166 06-13)
Avail: NTIS CSCL 08F

Remote-sensing techniques, particularly color infrared photography, are discussed as a rapid method of investigating estuaries and marshlands. Experimentation with color infrared film and various Wratten filters (15-G, 25-A, 61, 89-B) in estuarine and marshland studies of the Patuxent River, Maryland is considered. Conclusions are that color infrared film with use of various filters provides information on various water-quality parameters and vegetation composition not obtainable using other remote-sensing methods. The Wratten 15-G filter appears to be the most useful, but the Wratten 25-A filter may be superior in delineation of submerged aquatic plants. The Wratten 61 and 89-B filters provide a tool for specific plant type, distribution in marshes, and shoreline delineation.
Author

N71-16175*# Illinois Univ., Chicago.
APPLICATION OF RADAR IMAGERY TO DRAINAGE ANALYSIS
Roger M. McCoy *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 3 1968 18 p ref (See N71-16166 06-13)
Avail: NTIS CSCL 08F

Radar imagery was investigated for application in drainage analysis, with data taken from a K-band imaging system and U. S. Geological Survey topographic maps of the same drainage basins. The drainage basins were selected from a variety of terrain types including low, moderate, and high relief grasslands and forests. Procedures were established for drawing the stream network from topographic maps. Interpretation of the data included production of maps of the drainage network and morphometric analysis of drainage composition.
R.B.

N71-16176*# New York Univ., N.Y. Dept. of Meteorology and Oceanography.
RADAR SEA RETURN AS A FUNCTION OF WAVE HEIGHT AND WIND SPEED FOR FULLY DEVELOPED SEAS
Willard J. Pierson, Jr. *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 3 1968 27 p refs (See N71-16166 06-13)
Avail: NTIS CSCL 08C

The results of missions 20, 34, 60, and 70 are reanalyzed as a function of upwind, downwind, and crosswind conditions. Results are presented in both tabular and graphical form and in terms of mesoscale variability in the conditions at the sea surface, so that all possible sources of scatter are considered. The analysis is based on a total of 916 individual measurements of the radar scattering cross section versus the beam angle for three basically different, fully developed seas.
Author

N71-16177*# Naval Oceanographic Office, Washington, D.C.
SEA-STATE MEASUREMENTS WITH A RADAR PROFILOMETER
Lionel I. Moskowitz *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 3 1968 6 p refs (See N71-16166 06-13)
Avail: NTIS CSCL 08C

Mission 70, conducted in Iceland in early April 1968, had as a prime objective the determination of high sea states by radar scatterometry. For the purpose of defining the characteristic scatterometer curves, a test site was chosen which would offer a very good probability for providing high sea states and a suitable airbase for the NASA Manned Spacecraft Center P-3 aircraft. In addition, ground truth in the form of meteorological and oceanographic information was obtained from permanent weather stations located southwest, southeast, and east of Iceland. The aircraft used for ground truth measurements provided data pertaining to ocean wave heights, sea surface temperature, and temperature as a function of water depth.
Author

N71-16178*# Texas A&M Univ., College Station.
RADAR SCATTEROMETER MEASUREMENTS OF SEA ICE
J. W. Rouse, Jr. *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 3 1968 29 p refs (See N71-16166 06-13)
Avail: NTIS CSCL 08C

The radar data were recorded by a 13.3-gigahertz radar scatterometer, continuous wave Doppler instrument which measures the scattering coefficient of individual resolution cells over the range of incidence angles from 60 deg ahead to 60 deg aft of the aircraft. The fact that the data are related to individual cells (approximately 100 feet square) along the flight path and that the ice type was known for each cell resulted in signatures of the ice types. These signatures, in the form of scattering-coefficient curves versus incidence-angle curves, are sufficiently unique that ice-type discrimination is possible. Detailed analysis of three flight lines over different regions of the arctic ice pack is given. Each line is documented with aerial photography and continuous narration by a Navy aerographic observer. The analysis includes comparison of radar return amplitude as a function of time with the air photomosaic of the flight line, comparison of scattering-coefficient curves for various ice types, and an estimation of the surface statistics obtained by fitting the data to the backscatter theory based on the Kirchhoff-Huygens principle. Author

N71-16179*# Miami Univ., Coral Gables, Fla.
COMPARISON OF MICROWAVE RADIOMETRY OF THE OCEAN DURING HURRICANE BEULAH (MISSION 57) WITH SIMULATED OCEAN SURFACE MEASUREMENTS
G. F. Williams, Jr. *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 3 1968 8 p refs (See N71-16166 06-13)
Avail: NTIS CSCL 08C

In order to provide a general guide in the interpretation of airborne microwave radiometer data over the ocean, a limited set of measurements of a simulated ocean surface was conducted. The experiment was designed to measure the apparent or brightness temperature in the microwave region of an air-water interface under various conditions. The radiometers were installed in a NASA aircraft, which parked with a temporary test tank 8 feet in diameter erected below the radome housing the radiometers. As calibration points, measurements were made on the asphalt pavement and then on the sky reflected from aluminum sheets before the test tank was erected. The tank was filled with fresh water and the apparent temperature was recorded. The water surface was then disturbed by a water spray to simulate the impact of rain on the surface, and the temperature was recorded. Then, 1 ounce of detergent was added, and a high-pressure jet generated one-fourth to one-half inch of foam on the water surface, simulating the effects of foam and whitecaps, and the measurements were repeated. The raw temperatures require corrections based on antenna and radome losses and on pattern effects which are not yet accurately established for the radiometer system. Author

N71-16180*# Massachusetts Inst. of Tech., Cambridge. Experimental Astronomy Lab.
OCEAN BOTTOM SURVEYING WITH AERIAL PHOTOGRAPHY
A. C. Conrod and H. A. Short (Naval Oceanog. Office) *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 3 1968 17 p (See N71-16166 06-13)
Avail: NTIS CSCL 08J

The application of photography and spectrography to ocean surveying was investigated. Photographic tests show that good bottom detail may be obtained at depths ranging in some cases to more than 25 meters, and biological and geological features can be seen and interpreted. The method shows promise as a survey tool for examining the near-short environment and in studying land-sea interactions, both natural and artificial. Spectrometric experiments show that the kinds and amounts of suspended and dissolved water may be estimated with airborne radiometers. The uses of photography versus electro-optical imaging systems for possible operational use on ERSP and EROS satellites are mentioned, and some of the design and application aspects of nonphotographic imaging systems are discussed. Author

N71-16181*# Michigan Univ., Ann Arbor.
SURFACE EFFECTS AND SUBMERGED FEATURES
F. C. Polcyn *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 3 1968 18 p ref (See N71-16166 06-13)
(Contract N67306-67-C-0243)
Avail: NTIS CSCL 08J

The observables upon which remote sensors rely for location and measurement of submerged oceanographic features are color and thermal anomalies, wave refraction effects, and time differences of reflected laser pulses. These aspects for the identification and location of a particular depth of water (100 feet or less) are outlined. The various sensor types that could be employed to operate on these observables are suggested. The problems associated with the use of each observable were investigated and a series of experiments to verify their usefulness is recommended. One of the aspects of remote sensing that must be investigated is the conditions under which a reliable depth determination can be made from observed surface anomalies. Author

N71-16182*# Bureau of Commercial Fisheries, Pascagoula, Miss.
REMOTE SENSING OF FISHERY RESOURCES
Kirby L. Drennan *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 3 1968 2 p (See N71-16166 06-13)
Avail: NTIS CSCL 06C

The feasibility of locating, identifying, and quantifying surface and near-surface fish stocks from aircraft and future spacecraft is considered. The spectral properties, thermal patterns, and other characteristics associated with pelagic fish schools and surface fish-oil films, which permit location and identification through the use of remote sensors, are investigated. The potential application of image intensifiers for locating fish schools during nighttime operations from the bioluminescence associated with most schools is also discussed. Author

N71-16183*# California Univ., San Diego. Scripps Inst. of Oceanography.
AIR-SEA INTERACTIONS
E. D. McAlister *in* NASA. Manned Space Center Earth Resources Aircraft Program Status Rev., Vol. 3 1968 13 p (See N71-16166 06-13)
Avail: NTIS CSCL 08C

An infrared two-wavelength radiometer was developed to measure the heat flow to the ocean surface by measurement of water temperature at two different depths. The fraction of total heat flow by different mechanisms is shown as a function of depth. Turbulence dominates at depths up to a few millimeters, below which conduction becomes the dominant mode of transport. R.B.

N71-16184*# Texas A&M Univ., College Station. Dept. of Oceanography.
RESULTS OF REMOTE-SENSING TESTS FOR OCEANOGRAPHY AT TEXAS A AND M UNIVERSITY
Jack F. Paris *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 3 1968 51 p refs

(See N71-16166 08-13)
Avail: NTIS CSCL 08C

Airborne tests of multispectral remote sensors were conducted over the Mississippi Delta area and eastern Gulf of Mexico to determine the usefulness of the sensors in surveying river, coastal, and deep-sea phenomena. Four of these tests were supported concurrently by oceanographic research vessels. Passive remote sensors, principally metric microwave radiometers, were flown at 1500, 5000, 10,000, and between low cloud development and horizontal anomalies in the sea surface temperature field and studies into basic microwave research were conducted. The following features of the Mississippi River were surveyable by remote sensors from aircraft: (1) location of surface frontal zones of convergence, (2) determination of surface water mass type, (3) small-scale pattern of mixing, (4) location of internal waves, and (5) general outflow pattern shape and extent. Author

N71-16165*# Kansas Univ., Lawrence. Center for Research In Engineering Science.

RADAR PROGRESS IN THE NASA EARTH RESOURCES AIRCRAFT PROGRAM

R. K. Moore *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 3 1968 51 p refs (See N71-16166 08-13)
Avail: NTIS CSCL 08F

A historical survey is presented on the development of airborne radar scatterometers for application in earth resources surveys. The functions of the scatterometer and the imaging radar used in the Earth Resources Program are described. R.B.

N71-16229# Western Ontario Univ., London. Centre for Radio Science.

THE FORMATION OF IONOSPHERIC IRREGULARITIES

P. A. Forsyth *In* AGARD Appl. of Propagation Data to VHF Satellite Commun. and Navigation Systems Nov. 1970 6 p refs (See N71-16226 08-07)
Avail: NTIS

Although ionospheric irregularities in both the E-region and F-region have been studied extensively for many years there is no comprehensive picture available of the various ways in which such irregularities are formed. A brief discussion of each of those mechanisms which might reasonably contribute to the formation of ionospheric irregularities is presented. Author

N71-16233# University Coll. of Wales, Aberystwyth.

MEASUREMENT OF TOTAL ELECTRON CONTENT

L. Kersley *In* AGARD Appl. of Propagation Data to VHF Satellite Commun. and Navigation Systems Nov. 1970 9 p refs (See N71-16226 08-07)
Avail: NTIS

Theoretical aspects of the Faraday rotation of the plane of polarization and the Doppler shift of electromagnetic waves traversing an ionized medium are described. The use of the Faraday and Doppler effects in the estimation of ionospheric total electron content is considered for VHF signals from satellites in both low and geostationary orbits. Author

N71-16234# University Coll. of Wales, Aberystwyth.

EFFECTS OF HORIZONTAL GRADIENTS AND FURTHER CONSIDERATIONS OF TOTAL ELECTRON CONTENT MEASUREMENTS

L. Kersley *In* AGARD Appl. of Propagation Data to VHF Satellite Commun. and Navigation Systems Nov. 1970 7 p refs (See N71-16226 08-07)
Avail: NTIS

Approximations and sources of error inherent in total electron content measurements using the Faraday and Doppler effects on VHF signals from satellites are discussed and the main methods of measurement are compared. Author

N71-16321# International Business Machines Corp., Gaithersburg, Md. Federal Systems Div.

SYSTEM AND DESIGN STUDY FOR AN ADVANCED DRUM PLOTTER Final Technical Report

M. E. Friar, R. D. Hogan, P. J. Min, J. V. Sharp, and D. R. Thompson Apr. 1970 190 p refs
(Contract DAAK02-69-C-0015)
(AD-714378; USAETL-CR-70-3) Avail: NTIS CSCL 9/2

The report documents the results of a feasibility study to determine digital data processing techniques and supporting facsimile plotter hardware necessary to make large area color separation negatives suitable for map production. The report describes plotter design, graphic data processing techniques, the executive system program, and integration of software and hardware components. It has a section containing results of a systems study of the task of Computer-aided, cartographic quality map generation. The performance of the experimental system is discussed in detail using results obtained from the processing of five 14-inch x 22-inch input manuscripts. The processing included the scanning of the input documents, digital processing of the image data, and printing color separation negatives in facsimile image form with a facsimile drum plotter (2 and 4 mil resolution). The report also describes the use of digital techniques for creation of shaded relief from topographic profile data and the subsequent plotting of image, using a digital half-tone screen and the experimental plotting equipment. Author (GRA)

N71-16335# Atmospheric Sciences Lab., White Sands, Missile Range, N.Mex.

ELECTRICAL STRUCTURE OF THE D AND E-REGION

Willis L. Webb Forth Monmouth, N.J. ECOM Jul. 1970 28 p refs
(AD-714365; ECOM-5313) Avail: NTIS CSCL 4/1

Based on the stratopause tidal circulation model of dynamo current motivation through low-latitude vertical charge separation and the Hall effect, a sectional model illustrating the low-latitude global D- and E-region electrical structure is presented. Model conductivity structures are derived from mean electron density and collision frequency profiles and are applied to delineate atmospheric sources and sinks of electromotive energy and the resulting electric current and potential fields. These models indicate that the lower ionosphere rather than being electrically neutral is the site of important electrical structure which must be joined with the observed lower atmosphere and exospheric structures to obtain the complete global electrical structure. The lower ionospheric dynamo current is by far the largest atmospheric current and, therefore, dominates the global electrical structure, with tropospheric and exospheric electrical phenomena resulting principally from relaxation currents below and above the lower ionospheric region. Author (GRA)

N71-16336*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.

PLASMA IN THE EARTH'S POLAR MAGNETOSPHERE

L. A. Frank Nov. 1970 64 p refs
(Contract NAS5-9074)
(NASA-CR-116143; Rept-70-55) Avail: NTIS CSCL 03B

Results are presented of observations of the plasmas in the dayside polar magnetosphere obtained with the earth-satellite IMP 5 during July and August 1968. The observations, along with measurements from other earth satellites, are interpreted in terms of a magnetospheric model. Author

N71-16373# New York Univ., N.Y. Geophysical Sciences Lab.
SURFACE SALINITY VARIATIONS IN THE INNER GULF OF GUINEA AND THEIR RELATION TO EVAPORATION, PRECIPITATION AND VERTICAL MIXING
G. Neumann Aug. 1970 57 p refs
(Contract Nonr-285(57))
(AD-714492; GSL-TR-70-10) Avail: NTIS CSCL 8/10

An attempt is made to explain sea surface salinity variations from month to month in the ocean area east of Sao Tome Island in the inner Gulf of Guinea. Estimates of the monthly amounts of precipitation (P) and evaporation (E) in this area indicate that during most of the year P exceeds E. For the annual mean, E - P = -4.2 cm/month, and the seasonal variation of E - P is dominated by precipitation with a strong tendency toward a semiannual march. In addition to E - P, effects of vertical mixing are most significant, particularly in spring when subsurface water with high salinity is injected into this region by the Equatorial Undercurrent. The effect of mixing depicts an almost pure annual march. It is shown that the predominantly annual march of salinity near the sea surface can be essentially explained by evaporation, precipitation and vertical mixing. Author (GRA)

N71-16374# Illinois Univ., Urbana.
THE EFFECTS OF SURFACE ROUGHNESS ON THE SHEAR STRENGTH OF JOINTS IN ROCK Final Technical Report
James Hilton Coulson (Ph.D. Thesis) Oct. 1970 315 p refs
(Contract DACA45-67-C-0009)
(AD-714244; MRD-TR-2-70) Avail: NTIS CSCL 8/7

The shear strength of a discontinuity, or joint, in a rock mass is derived from two components: (1) the frictional component offered by two flat surfaces sliding relative to one another, plus (2) the geometrical component derived from the necessity of interlocking surface irregularities to be overridden or sheared off as sliding commences. The chief purpose of this investigation has been to determine the manner in which surface preparation affects the frictional component of shear strength. Flat surfaces in basalt, dolomite, limestone, sandstone, siltstone, granite, and schistose gneiss, prepared by lapping with fine no. 600 grit, by lapping with coarse no. 80 grit, and by sandblasting, have been sheared wet and dry under normal pressures from 10 to 1000 psi. To supplement test data from the flat surfaces, tests were also performed on natural joints in granite and siltstone, on joints in granite grouted with neat cement, and along intact bedding in two shales. In all, approximately 1000 shear tests were performed using a high-capacity directshear machine designed specifically for this testing program. Author (GRA)

N71-16376# New York Univ., N.Y. Geophysical Sciences Lab.
OBSERVATIONS OF THE EFFECTS OF THIRD ORDER DEEP WATER GRAVITY WAVE INTERACTIONS
W. J. Pierson, M. S. Chang, E. Mehr, G. McNally, and L. Amelio Aug. 1970 57 p refs
(Contract Nonr-285(57))
(AD-714493; GSL-TR-70-12) Avail: NTIS CSCL 8/3

An experiment is designed to test whether or not resonant waves produced by two intersection trains of long-crested gravity waves can exist independently of their generating source and whether or not these waves can produce standing waves. The results of the experiment were inconclusive. Indications that the resonant wave had these properties were counterbalanced by indications that the sought-for effects were just as strong for non-resonant components. Difficulties were encountered because of the small scale of the experiment. It is recommended that the experiment be scaled up to a larger wave tank because of the practical importance of the problem in wave forecasting. Author (GRA)

N71-16377# Technische Hochschule Munchen (West Germany). Elektrophysikalisches Inst.
SIMULTANEOUS MEASUREMENTS ELF-ATMOSPHERICS BY SEPARATE STATIONS Final Scientific Report, 1 Nov. 1964–31 Mar. 1970
Herbert L. Koenig and Kurt H. Behringer 1 May 1970 30 p refs
(Contract AF 61(052)-836)
(AD-713890; AF-70-0443; Rept-836/2) Avail: NTIS CSCL 4/1

The present research program has been carried out to obtain more detailed information about the propagation phenomena and the origin of ELF-waves in the frequency range of the SCHUMANN-resonances, i.e. between 4 and 24 Hz. Therefore simultaneous measurements of both the magnetic and the electric field have been performed by two almost identically equipped recording stations. One station is located near Kingston, R. I., and supervised by members of the University of Rhode Island, the other one, operated by the authors, is situated in Brannenburg, W-Germany. The results of these cooperative investigations will permit prediction of the state of the lower ionosphere and of some types of Solar events. The low level of the measured signals demanded the construction of sensitive antennas and amplifiers, while the elimination of the very intense manmade interferences required the development of appropriate filtering systems. These difficulties have been successfully overcome by the use of special equipment at the field stations. The present report gives a description of the constructional features of the Brannenburg field station. A review of the principles of operation is followed by descriptions of the different units of the appratus. In addition, some interesting details of the circuitry are presented to give examples of the solution of specific problems. Author (GRA)

N71-16379*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
THE MAN-RELATED ACTIVITIES OF THE GULF STREAM DRIFT MISSION
Chester May 21 Sep. 1970 32 p refs
(NASA-TM-X-64548) Avail: NTIS CSCL 08C

The man-related activities of the Gulf Stream Drift Mission (GSDM) were studied. The primary objective of the GSDM was to permit the Ben Franklin, a deep submersible vehicle, to drift with the Gulf Stream at depths from 600 to 2000 feet while the crew performed scientific oceanographic studies. The Ben Franklin is a 50-foot-long, 10-foot-diameter cylinder designed for a 200-foot operational depth and 36 man-weeks of life support. The feasibility of utilizing an undersea vehicle as a space station analog to study living and working problems, and as a potential hardware test bed, was evaluated. The GSDM satisfied the following space station operations analog requirements: (1) provided a real scientific mission; (2) simultaneously removed the crew from their natural social environment and from their natural earth environment; and (3) provided similar confinement, a similar closed environment with associated embedded stress conditions, and similar crew sizes and backgrounds. Based on these similarities, a NASA study program was developed. Author

N71-16380# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section
REPORT ON GRAVIMETRIC WORK COMPLETED IN THE SOVIET UNION FROM 1966 TO 1969 ON SUBJECTS OF THE INTERNATIONAL GRAVITY COMMISSION
Oct. 1970 21 p refs Transl. into ENGLISH from 'Otchet o Gravimetricheskikh Robotakh, Vypoloennykh Sovetskom Soyuze v 1966-1969 GG. po Tematike Mezhdunarodnoy Gravimetricheskoy Komissii' Miscow, Akad. Nauk SSSR, Sov. Geofiz. Komis. 1970 p 1-16
(AD-714386; ACIC-TC-1668) Avail: NTIS CSCL 8/5

The paper is a report on gravimetric work completed in the Soviet Union from 1966 to 1969. This work was carried out in the following divisions: Fundamental gravity determinations; Gravity determinations at sea; Study of the gravity variations; Development of instruments and methods for determining the vertical gravity gradient and Tidal variations of gravity. Some general theoretical problems of absolute gravity determinations by the method of free fall were investigated. Studies of the influence of gravity acceleration with elevation and resistance of the medium proportional to the first and second powers of velocity of a falling body, on the results of measurements were conducted by asymmetric method of three stations, symmetric method of two stations and symmetric method of one station. The planning of the installation for absolute determination according to the symmetric method of one station has begun. A series of theoretical and experimental investigations on the perfection of marine gravimeters and estimation of their accuracy was carried out. Studies relating to secular variations of the gravitational force, measurements of the vertical gradient of gravity, and earth tides in the USSR during 1967-1970 are considered. Author (GRA)

N71-16387# Sandia Corp., Albuquerque, N.Mex. Aerodynamics Div.

DEVELOPMENT OF SEA ICE PENETROMETER

C. W. Young and J. L. Kiker Aug. 1970 85 p refs

(SC-DR-70-483) Avail: NTIS

A series of drop tests was performed in fast winter ice to demonstrate the feasibility of remotely determining the thickness of sea ice by using instrumented, air-dropped penetrometers. Seven drop tests were made to study the effect of projectile weight (25 to 100 pounds), weight-to-area ratio (5.4 to 11.2 pounds per square inch), impact velocity (200 to 345 feet per second), and ice condition (sea ice and one test in a brackish lagoon). It appears that an optimum configuration for an ice penetrometer weighs 50 pounds, is 2.75 inches in diameter, and should impact the ice at 450 to 500 feet per second. The index of penetrability for the sea ice was 2.8, which corresponds in penetrability to an extremely hard soil or very soft rock. The ice thickness was determined to an accuracy of + or − 4 inches, but by using techniques developed during these tests, it is estimated the ice thickness can be determined to + or − 2 inches in future tests. Author (NSA)

N71-16388# Geological Survey, Denver, Colo.

ESTIMATION OF IN-SITU ACOUSTIC PROPERTIES OF VOLCANIC ROCKS FROM CONGRESSIONAL VELOCITY MEASUREMENTS: CENTRAL NEVADA

R. D. Carroll and J. E. Paul 1970 28 p refs

(Contract AT(29-2)-474)

(USGS-474-69) Avail: NTIS

Comparisons of in situ compressional- and shear-wave velocities with dynamic elastic moduli and acoustic impedance of volcanic rocks penetrated by drill holes indicate that the compressional velocity is an excellent indicator of the acoustic parameters of these rocks. The agreement of the results with those obtained in an earlier investigation, based chiefly on laboratory results obtained from measurements on dry core, supports the conclusion that simple prediction equations for acoustic parameters based on compressional-wave velocity probably exist for many regions containing volcanic or other siliceous rocks. Author (NSA)

N71-16420# Wisconsin Univ., Madison. Mathematics Research Center.

A BOUNDEDNESS THEOREM FOR TWO-DIMENSIONAL WAVES OVER A SLOPING BEACH

M. C. Shen Jan. 1970 19 p refs

(Contract DA-31-124-ARO(D)-462; Nonr-1202(27); Grant NSF GP-11319)

(AD-714150; MSC-TSR-1042) Avail: NTIS CSCL 8/3

The paper aims to make a direct contribution to the question of resonance of two-dimensional, bore-free waves on a continental slope of small, uniform inclination. The boundedness theorem obtained here shows that an unbounded solution is inconsistent with bounded initial and boundary conditions. Author (GRA)

N71-16465*# Translation Consultants, Ltd., Arlington, Va.

PHYSICAL PROPERTIES OF ROCKS IN STRUCTURAL-FORMATION ZONES OF THE NORTHERN CAUCASUS AND THEIR IMPORTANCE IN INTERPRETING GEOPHYSICAL DATA [FIZICHESKIYE SVOYSTVA GORNYKH POROD V STRUKTURNO-FORMATSIONNYKH ZONAKH SEVERENOGO KAVKAZA I IKH ZNACHENIYE DLYA INTERPRETATSII GEOFIZICHESKIKH DANNYKH]

G. D. Afanas'yev et al Washington NASA Jan. 1971 42 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Geol. (Moscow), no. 9, 1965 p 5–27

(Contract NASw-2038)

(NASA-TT-F-13415) Avail: NTIS CSCL 08G

Investigations of the physical properties of rocks of the Northern Caucasus are described, and research confirms the specific nature of the physicomechanical properties of different granitoid rocks caused by the depth of their crystallization and degree of metamorphism. Author

N71-16493# RAND Corp., Santa Monica, Calif.

TIDAL OSCILLATIONS IN THE THERMOSPHERE AND THEIR IMPLICATIONS FOR UPPER ATMOSPHERE DENSITY MODELS

E. S. Batten Oct. 1970 126 p refs

(Contract F44620-67-C-0045; Proj. Rand)

(AD-714583; R-585-PR) Avail: NTIS CSCL 4/1

A study is made of the variation of atmospheric parameters in the lower thermosphere (80-150 km) in terms of the theory of atmospheric tides. The existing tidal theory is expanded to include the effects of dissipation and excitation in the thermosphere. The effects of heat conductivity and absorption of solar radiation in the thermosphere are added to the existing tidal theory. The results are then compared with observations of winds in the lower thermosphere to determine the extent to which the tidal theory can explain the observed variations of meteorological variables in the lower thermosphere. Results indicate that many features of lower thermospheric wind profiles can be explained in terms of tidal theory, including the effects of dissipation and thermospheric heating. Author (GRA)

N71-16502*# Translation Consultants, Ltd., Arlington, Va.

AIR DENSITY DISTRIBUTION IN THE STRATOSPHERE [O RASPREDELENII PLOTNOSTI VOZDUKHA V STRATOSFERE]

K. T. Logvinov Washington NASA Jan. 1970 8 p refs Transl. into ENGLISH from Tr. Nauchn.-Issled. Inst. Aeroklimatologii (USSR), no. 58, 1969 p 116–121

(Contract NASw-2038)

(NASA-TT-F-13456) Avail: NTIS CSCL 04A

Information on density distribution in the atmosphere, obtained from USSR rocket soundings, is provided. Available data from both USSR and other soundings are too sparse to draw other than tentative conclusions. Author

N71-16509*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

AVERAGE AND UNUSUAL LOCATIONS OF THE EARTH'S

MAGNETOPAUSE AND BOW SHOCK
Donald H. Fairfield Dec. 1970 44 p refs Submitted for publication
(NASA-TM-X-65429; X-692-70-452) Avail: NTIS CSCL 04A

A best fit ellipse and hyperbola were calculated to represent several hundred magnetopause and bow shock positions observed by six IMP spacecraft. Average geocentric distances to the magnetopause and bow shock near the ecliptic plane are 11.0 R sub E and 14.6 R sub E in the sunward direction, 15.1 R sub E and 22.8 R sub E in the dawn meridian and 15.8 and 27.6 R sub E in the dusk meridian. The bow shock hyperbola is oriented in a direction consistent with that expected considering aberration of a radial solar wind. Observed magnetopause crossings agree well with theoretical predictions in the noon meridian plane but fall outside the theoretical boundaries in the dawn-dusk meridian planes. IMP 4 plasma data are used to demonstrate that the solar wind momentum flux is the prime factor controlling the orbit-to-orbit changes in the boundary positions. Data suggest that the interplanetary field orientation also affects the distance to the magnetopause boundary with more earthward crossings corresponding to southward fields. Six unusual bow shock locations up to 22 R sub E beyond the average position are found to be due to an enhanced standoff distance associated with a low Alfven Mach number. The possibility is raised that the solar wind may have become sub-Alfvenic on July 31, 1967. Author

N71-16510# Joint Publications Research Service, Washington, D.C.
SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 243
30 Dec. 1970 83 p Transl. into ENGLISH from Russian reports (JPRS-52087) Avail: NTIS

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1. ASTRONOMY p 1-4 (See N71-16511 06-30)
2. METEOROLOGY p 5-14 (See N71-16512 06-20)
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4. TERRESTRIAL GEOPHYSICS p 27-35 (See N71-16514 06-13)
5. UPPER ATMOSPHERE AND SPACE RESEARCH p 36-58 (See N71-16515 06-30)
6. OPERATIONS OF CHERNOMOR SEALAB: SUPPLEMENT p 60-76 (See N71-16516 06-13)

N71-16513# Joint Publications Research Service, Washington, D.C.
OCEANOGRAPHY
In its Soviet-Bloc Res. in Geophys. Astronomy, and Space, No. 243 30 Dec. 1970 p 15-26 (See N71-16510 06-13)
Avail: NTIS

News items and research abstracts on the following topics are summarized: exploitation of placer deposits along coasts, operations of the scientific research ships AKADEMIK KURCHATOV and OKEAN, experimental studies of ocean turbulence, numerical modeling of ocean and atmospheric circulation, and the use of automation and computers in oceanology. Other investigations summarized include: spatial and temporal variability of tidal mixing caused by internal waves, electric analogs in marine dynamics, microorganism growth on petroleum and self-purification of the sea, biochemistry and chemical composition of plankton, tidal water temperature fluctuations in the Gulf Stream, equatorial vertical circulation in the western Pacific Ocean, ethmodiscus in Pacific Ocean plankton, and the role of bacterioplankton in organic matter cycling in the tropics. E.C.

N71-16514# Joint Publications Research Service, Washington, D.C.
TERRESTRIAL GEOPHYSICS
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 243 30 Dec. 1970 p 27-35 (See N71-16510 06-13)
Avail: NTIS

News items and research abstracts on the following topics are summarized: base for seismology in Zailiyskiy Alatau Mountains, field magnetic variation station for T and Z variations, vertical seismic profiling. Other topics reviewed include: theory of oscillations for spherically earth asymmetric models, deep magnetotelluric sounding in Yakutia and Murmansk Oblast, solar wind and earth electromagnetic field correlation, velocity cross section of lower mantle, wave characteristics fluctuations and fine crustal inhomogeneity, dielectric characteristics of rocks, and polarization of Pi2 geomagnetic pulsations. An outline of a book on gravimetry at sea is also given. E.C.

N71-16516# Joint Publications Research Service, Washington, D.C.
[OPERATIONS OF CHERNOMOR SEALAB: SUPPLEMENT]
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 243 30 Dec. 1970 p 60-76 (See N71-16510 06-13)
Avail: NTIS

Operations highlights from the ships logbook of the underwater laboratory CHERNOMOR-2 (BLACK SEA-2) and its satellite laboratory SPRUT-5 (OCTOPUS-5) are presented. E.C.

N71-16547# Woods Hole Oceanographic Institution, Mass.
OPERATIONAL TECHNIQUE FOR CONTINUOUS SEISMIC PROFILING AND RELATED STUDIES, 1970
S. T. Knott Sep. 1970 116 p refs
(Contracts N00014-70-C-0205; N00014-66-C-0241)
(AD-714167; WHOI-REF-70-43) Avail: NTIS CSCL 8/10

The present status of the oceanic continuous seismic profiling (CSP) apparatus and techniques used by the Department of Geology and Geophysics at the Woods Hole Oceanographic Institution is described. Emphasis is given to discussions of source characteristics and to the collection of calibrated data with the latest broadband receiving systems. The establishment of seismic stations at which specific controlled measurements may be obtained is introduced. Author (GRA)

N71-16548*# Old Dominion Univ. Research Foundation, Norfolk, Va.
TRIAD: PRELIMINARY DESIGN OF AN OPERATIONAL EARTH RESOURCES SURVEY SYSTEM. 1969 SUMMER FACULTY FELLOWSHIP PROGRAM IN ENGINEERING SYSTEMS DESIGN
Keith R. Carver, F. D. Hart, C. E. Jarvis, J. D. Lowther, and F. L. Moreadith, eds. 22 Aug. 1969 148 p refs
(Contract NSR-47-003-010)
(NASA-CR-116200) Avail: NTIS CSCL 08D

The results of a multidisciplinary system design study directed towards the definition of a preliminary design concept for an operational earth resources survey program are presented. The study includes: (1) evaluation of social needs in relation to basic resources of food, raw materials, power and conservation, (2) technological, political, and social feasibility, and (3) description of an operational system. World problems of a socio-economic nature pertinent to the survival and progress of civilization are summarized. Also, the disciplines of agronomy, geology, geography, oceanography, hydrology, and others, are surveyed from a user-agency point of view. Specific data needs are presented that existing agencies have expressed a desire to acquire. Parameters to be measured, minimum resolution requirements, and likely

sensors are indicated for each need. A total concept for an operational earth resource survey system is discussed. This includes types of data to be acquired, specifications of sensors and platforms, data processing and distribution, and illustration of an administrative structure for carrying out an operational program. Author

N71-16550# Naval Postgraduate School, Monterey, Calif.
WEIGHING AT SEA WITH A GIMBAL PLATFORM
Charles Manfred St. Laurent (M.S. Thesis) Sep. 1970 110 p refs
(AD-714606) Avail: NTIS CSCL 8/10

The use of a gimbal platform with two degrees of freedom under dampened pendulum motion allows a standard laboratory balance to be used to weigh scientific samples at sea. The maximum sample weight tested was approximately 120 grams, while the average accuracy obtained in samples ranging from 1 to 120 grams was 0.10% (plus or minus .05%). The sea conditions under which at-sea weighings can be conducted vary with the size of the research vessel. The gimbal platform does not provide the stabilization necessary under adverse sea conditions. Author (GRA)

N71-16562*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
METEOROLOGICAL USES OF THE STEROGRAPHIC HORIZON MAP PROJECTION
William E. Shenk, Hugh Powell (Computer Applications, Inc.), Vincent Salomonson, and William R. Bandeen Washington Feb. 1971 21 p refs
(NASA-TN-D-7009; G-1012) Avail: NTIS CSCL 08E

An algorithm was developed for converting a polar sterographic projection to a stereographic horizon projection. A distortion analysis showed that linear distortions relative to the map center are less than 10% within 35 deg of great circle arc from the center. Two types of meteorological systems were examined with meteorological satellite infrared radiation data placed in the new map projection to illustrate its use. The cloud pattern evolution (as seen through an infrared atmospheric window) associated with a rapidly developing extratropical storm was used to depict how the sterographic horizon map projection quantitatively reveals the major centers of cloud development, movement, and dissipation relative to the cyclone center. With the stereographic horizon projection, the classical dynamic features of the jet stream appeared to be present in the appropriate quadrants of a composite of Nimbus 3 infrared (6.4 to 6.9 micrometer) radiation data surrounding 13 jet stream speed maxima. Author

N71-16567# Woods Hole Oceanographic Institution, Mass.
EXPERIENCE WITH A DRIFTING IRLS BUOY
G. C. Ewing and Foster L. Striffler Oct. 1970 12 p ref
(Contract N00014-66-C-0241)
(AD-713948; WHOI-REF-70-53) Avail: NTIS CSCL 13/10

The report gives a description and results of an operational test of an IRLS (Interrogation, Recording and Location Subsystem) free-floating buoy conducted in Woods Hole Harbor and in the vicinity of Georges Bank in conjunction with NASAS NIMBUS II SATELLITE. Author (GRA)

N71-16571# Army Electronics Command, Fort Monmouth, N.J.
A STATISTICAL MODEL FOR THE ANALYSIS OF SIMULTANEOUS TWO-STATION IONOSPHERIC SOUNDINGS
Erwin Biser and Richard D'Accardi Sep. 1970 45 p refs Presented at the 15th Conference on the Design of Experiments and Testing in Army R and D, Redstone Arsenal, Ala., 22 Oct. 1969
(AD-714192; ECOM-3336) Avail: NTIS CSCL 4/1

Ionosonde data characteristics (critical frequencies) change as the distance between two stations is varied from 0-500km. Two statistical models, namely, the Paired Difference model, and the Paired Comparison model, were used to analyze simultaneous vertical incidence (one station) and oblique incidence (two station) data. The analysis was performed with data taken over a 60km path between Fort Monmouth, New Jersey and Fort Dix, New Jersey as preliminary to subsequent testing of various path lengths up to 500km. The analysis was performed with two objectives in mind: (a) To determine whether or not vertical incidence data and oblique incidence data are sufficiently good estimators of each other over a short distance. (b) To determine confidence intervals as a means to compare the two models, and to show a gain of information resulting from the paired difference model. A decision theoretic approach is applied to the two statistical models to attain the objectives. Author (GRA)

N71-16581# Woods Hole Oceanographic Institution, Mass.
A COMPILATION OF MOORED WIND AND CURRENT METER OBSERVATIONS
Raymond T. Pollard Sep. 1970 121 p
(Contract N00014-66-C-0241)
(AD-714529; WHOI-REF-70-40) Avail: NTIS CSCL 8/3

Summaries of wind and current measurements made with current meters and wind recorders by the Woods Hole Oceanographic Institution during the year 1965 are presented. Averaged quantities are presented in computer-generated output as histograms, basic statistics, spectra, progressive vector diagrams, and east-north component plots. Author (GRA)

N71-16582# National Air Pollution Control Administration, Washington, D.C. Div. of Abatement.
METROPOLITAN TOLEDO INTERSTATE AIR QUALITY CONTROL REGION
Charles A. Kossack Aug. 1970 15 p refs
Avail: Issuing Activity

On April 13, 1970, the Metropolitan Toledo Interstate Air Quality Control Region was designated. The region consists of Lucas and Wood Counties in Ohio and Monroe County in Michigan. Presented is the current status of the Federal facilities in the region with regard to implementation of the objectives prescribed by the Clean Air Act and Executive Order 11507. Quantitative data on fuel burning, refuse disposal practices and air pollutant emissions, are included. The data in this report reflect that most recently available. Author

N71-16583# Washington Univ., Seattle. Div. of Marine Resources.
AIDJEX BULLETIN: ARCTIC ICE DYNAMICS JOINT EXPERIMENT
Sep. 1970 41 p
(AD-713986; Bull-1) Avail: NTIS CSCL 8/12

The Arctic ice dynamics joint experiment is a common purpose and a cooperative effort to understand quantitatively the interaction between the fields of motion of the atmosphere, the pack ice, and the liquid ocean. This understanding is basic to forecasting ice conditions and to assessing variations in surface/atmosphere heat exchange and their relation to variations in general atmospheric circulation. Author (GRA)

N71-16589*# Pittsburgh Univ., Pa. Space Research Coordination Center.
DIFFERENTIAL ELECTRON FLUX AS DETERMINED BY AURORAL OBSERVATIONS OF THE N2 POSITIVE AND N2(+) SYSTEMS

D. E. Shemansky, T. M. Donahue, and E. C. Zipf Jan. 1971 20 p refs
(Grant NGL-39-011-002)
(NASA-CR-116240; SRCC-146) Avail: NTIS CSCL 04A

The relative emission rates of the auroral N2 positive and N2(+) systems can be used as measures of the differential electron flux distribution function, due to the remarkable differences in electron excitation functions. Observations of aurora over the years have suggested that the four major systems are excited mainly by electrons. Calculations of relative emission rates using recently measured electron cross-sections are entirely consistent with the ground based and rocket-borne measurements. Author

N71-16606# Environmental Research Corp., Alexandria, Va.
ELASTIC ENERGY AND MAGNITUDE DETERMINATION FOR UNDERGROUND DETONATIONS IN TUFF AND RHYOLITE
John R. Murphy and Richard A. Mueller May 1970 42 p refs
(Contract AT(29-2)-1163)
(NVO-1163-208) Avail: NTIS

An expression for the elastic energy produced by a contained underground nuclear detonation is derived using an analytic approximation for the pressure profile acting at the elastic radius. The resulting static strain energy and radiated energy equations are evaluated as a function of yield and depth of burial for detonations in tuff and rhyolite. It is shown that the elastic energy efficiency depends only on the depth of burial (h). Seismic spectrum scaling theory is applied to an analysis of the relationship between nuclear and earthquake seismic source functions, giving results which are in good agreement with the observed differences in the teleseismic magnitude determinations. A magnitude-energy equation is derived for underground nuclear detonations and is noted to be in poor agreement with the Gutenberg-Richter equation. A possible explanation for this discrepancy is presented which suggests that the radiated energy from small earthquakes may typically have been underestimated. NSA

N71-16613# Fairchild Hiller Corp., Farmingdale, N.Y. Republic Aviation Div.
REPORT ON THE FLIGHT TEST PHASE OF A BASIC SYSTEM FOR VECTOR MAGNETIC FIELD MEASUREMENTS FROM A JAVELIN ROCKET NOSE CONE Final Report, 1 Dec. 1965 - 15 Sep. 1970
S. R. Cohen 15 Sep. 1970 144 p refs
(Contract AF 19(628)-5734)
(AD-714088; PCK-TR-70-3; PC129R0001; AFCRL-70-0458) Avail: NTIS CSCL 8/14

A flight evaluation of a system for the measurement of earth magnetic field components, using a vapor magnetometer and orthogonal biasing coils is described. The magnetic field components relative to an earth-fixed frame is inferred from the output of an antenna array installed for the purpose of establishing vehicle orientation relative to a ground based illuminating radar beam. The flight vehicle, ground based instrumentation, and data reduction techniques are described. Two vehicle launches were carried out from the Churchill Research Range. Payload tumbling in both flights prevented full evaluation of the measurement system. Author (GRA)

N71-16614# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
ON THE EQUATION OF GRAVITY [PRO RIVNYANNYA SYLY TYAZHINNYA]
A. V. Chornyy Sep. 1970 9 p refs Transl. into ENGLISH from Dopovidi Akad. Nauk Uk. SSR (Kiev), no. 2, ser. B, 1969 p 145 148
(AD-713863; ACIC-TC-1651) Avail: NTIS CSCL 8/5

The paper discusses the equation of gravity. In the same way as a graphic representation of some function sometimes appears too coarse, and in such case, is defined more accurately by the use of the differential properties of this function, so also the representation of the scalar field of gravity potential can be defined more precisely by means of level surfaces, if its description will be supplemented by the differential characteristics of these surfaces. The later denote the differential correlations, which are satisfied by the value of intensity of the gravity field potential. Author (GRA)

N71-16615# RAND Corp., Santa Monica, Calif.
USE OF SCATTERING TECHNIQUES IN CLOUD MICROPHYSICS RESEARCH. 1: THE AUREOLE METHOD
D. Deirmendjian Oct. 1970 47 p refs
(Contract F44620-67-C-0045)
(AD-714582; R-590-PR) Avail: NTIS CSCL 4/1

A simple, physically clear method is discussed for assessing the amount of atmospheric turbidity on a cloudless day by observing the circumsolar aureole--the ring of brightness around the sun--and comparing its brightness with that of the equivalent Rayleigh scattering (particle-free) atmosphere. The aureole is known to be caused by aerosols. This report applies exact Mie theory phase functions for idealized polydispersions of spherical particles to account for the aureole. It shows that the brightness gradient within a disc of 10-deg radius around the sun indicates the size distribution of the aerosol particles, and the overall extent of the aureole within 40 deg around the sun indicates the degree of turbidity. Author (GRA)

N71-16620# Development and Resources Transportation Co., Silver Spring, Md.
AUTOMATIC PROCESSING OF ARCTIC PACK ICE DATA OBTAINED BY MEANS OF SUBMARINE SONAR AND OTHER REMOTE SENSING TECHNIQUES Technical Report, 1 Dec. 1969 - 15 Sep. 1970
Leonard A. Le Schack, William D. Hibler, and Frederick H. Morse Sep. 1970 57 p refs
(Contract N00014-70-C-0110)
(AD-713911; D/RT-5) Avail: NTIS CSCL 8/12

Automatic processing and analysis of three types of remote sensing data of arctic pack ice are described. The primary emphasis is on upward-looking sonar profiles of the underside of pack ice obtained during the winter 1960 arctic cruise of the SSN 583, SARGO. Two traverses, one in the Chukchi Sea and one in the Beaufort Sea were studied. Segments of the profiles were analyzed by power spectrum and frequency distribution of amplitude techniques. Power spectrum analysis indicated preferred spacing of pressure ridges with apparent periods of 20-25, 35-40 and 80-100 m. Comparison of the power spectra of two profiles intersecting at a right angle showed the expected spatial period shift of significant ice ridge ensembles and so suggests a potential real-time technique for determining, from submarines cruising submerged, ice ridge orientation. Author (GRA)

N71-16655# National Air Pollution Control Administration, Raleigh, N.C. Div. of Air Quality and Emission Data.
CONTINUOUS AIR MONITORING PROJECTS: 1968 DATA TABULATIONS AND SUMMARIES, ST. LOUIS
Dec. 1969 107 p
(PB-194762; APTD-69-19) Avail: NTIS CSCL 13B

Hourly average concentrations of six gaseous pollutants (carbon monoxide, nitric oxide, nitrogen dioxide, sulfur dioxide, total hydrocarbons, and total oxidants), and 2-hour measurements of soiling index levels are tabulated. A brief summary of monthly means and maximums and graphs of seasonal diurnal patterns of

gaseous pollutants are included. Annual frequency distributions of the data pertaining to gases and soiling index are tabulated for St. Louis.
Author (USGRDR)

N71-16656# National Air Pollution Control Administration, Raleigh, N.C. Div. of Air Quality and Emission Data.
CONTINUOUS AIR MONITORING PROJECTS: 1968 DATA TABULATIONS AND SUMMARIES, WASHINGTON, D.C.
Dec. 1969 104 p
(PB-194763; APTD-69-20) Avail: NTIS CSCL 13B

Hourly average concentrations of six gaseous pollutants (carbon monoxide, nitric oxide, nitrogen dioxide, sulfur dioxide, total hydrocarbons, and total oxidants), and 2-hour measurements of soiling index levels are tabulated. A brief summary of monthly means and maximums and graphs of seasonal diurnal patterns of gaseous pollutants are included. Annual frequency distributions of the data pertaining to gases and soiling index are tabulated for Washington, D.C.
Author (USGRDR)

N71-16657# National Air Pollution Control Administration, Raleigh, N.C. Div. of Air Quality and Emission Data.
CONTINUOUS AIR MONITORING PROJECTS: 1968 DATA TABULATIONS AND SUMMARIES, DENVER
Dec. 1969 104 p
(PB-194760; APTD-69-17) Avail: NTIS CSCL 13B

Hourly average concentrations of six gaseous pollutants (carbon monoxide, nitric oxide, nitrogen dioxide, sulfur dioxide, total hydrocarbons, and total oxidants), and 2-hour measurements of soiling index levels are tabulated. A brief summary of monthly means and maximums and graphs of seasonal diurnal patterns of gaseous pollutants are included. Annual frequency distributions of the data pertaining to gases and soiling index are tabulated for Denver.
Author (USGRDR)

N71-16658# National Air Pollution Control Administration, Raleigh, N.C. Div. of Air Quality and Emission Data.
CONTINUOUS AIR MONITORING PROJECTS: 1968 DATA TABULATIONS AND SUMMARIES, PHILADELPHIA
Dec. 1969 104 p
(PB-194761; APTD-69-18) Avail: NTIS CSCL 13B

Hourly average concentrations of six gaseous pollutants (carbon monoxide, nitric oxide, nitrogen dioxide, sulfur dioxide, total hydrocarbons, and total oxidants), and 2-hour measurements of soiling index level are tabulated. A brief summary of monthly means and maximums and graphs of seasonal diurnal patterns of gaseous pollutants are included. Annual frequency distributions of the data pertaining to gases and soiling index are tabulated for Philadelphia.
Author (USGRDR)

N71-16663# Michigan Univ., Ann Arbor. Inst. of Science and Technology.
THE MEASUREMENT OF WATER DEPTH BY REMOTE SENSING TECHNIQUES
F. C. Polycyn, W. L. Brown, and I. J. Sattinger Oct. 1970 48 p refs
(Contract N62306-67-C-0243)
(AD-714001; Rept-8973-26-F) Avail: NTIS CSCL 8/10

The study demonstrates successful remote determination of shallow water depth by measuring wave refraction changes and using the Fourier transform plane for wavelength measurements with data obtained at a Lake Michigan test site. The study shows that the technique is suitable for use from spacecraft altitudes, provided that water waves of suitable length occur in the region of interest.
Author (TAB)

N71-16664# Naval Postgraduate School, Monterey, Calif.
A NUMERICAL INVESTIGATION OF TIDAL CURRENT CIRCULATION IN THE GULF OF MAINE
Arthur Paul Drennan (M.S. Thesis) Oct. 1970 73 p refs
(AD-714612) Avail: NTIS CSCL 8/3

The hydrodynamical-numerical model of Walter Hansen is used to compute tidal heights and tidal currents in the Gulf of Maine. The model uses two adjacent open boundaries at which the tides are prescribed at each time step, using four tidal constituents. The grid size is six nautical miles and the time step is thirty-one seconds. Seven data runs are reported; one uses the tides and no wind and the remaining six use uniform wind fields in consort with the tides. A modified method of handling the topographic data is used. The pertinent results of the study are: (1) the use of Hansens Model with adjacent open boundaries produces broad subjective agreement with observed data, (2) the modified method of handling topographic input data is workable, (3) wind direction and velocity produce slight variations in tidal height, (4) wind direction and velocity modify the direction of the tidal currents considerably and produce some significant increases in tidal current speed, and (5) the modifying influences of wind fields on tidal heights, tidal current velocities, and tidal current directions are more noticeable in shallow water areas than in regions of deep water.
Author (GRA)

N71-16718# Environmental Research Corp., Las Vegas, Nev.
SEISMIC SPECTRUM SCALING OF UNDERGROUND DETONATIONS
Richard A. Mueller and John R. Murphy Mar. 1970 80 p refs
(Contract AT(29-2)-1163)
(NVO-1163-195) Avail: NTIS

A general scaling theory of ground motions resulting from underground nuclear detonations is developed from the solution of the wave equation with appropriate boundary conditions. The analysis shows that in addition to yield, the device depth of burial and the medium play a significant role in the scaling of seismic signals. The theory predicts an increase in the dominant frequency and ground accelerations with an increase of device depth of burial. This phenomenon is verified by observations from excavation events and overburied events. For events buried sufficiently deep for containment, the scaling theory predicts frequency dependent yield exponents (ranging from 0.90 at low frequencies to 0.45 at high frequencies) which are in good agreement with empirical relations statistically derived from a large number of events.
Author (NSA)

N71-16726# National Air Pollution Control Administration, Raleigh, N.C. Div. of Air Quality and Emission Data.
THE 1968 DATA TABULATIONS AND SUMMARIES: CONTINUOUS AIR MONITORING PROJECTS: NATIONAL AIR SURVEILLANCE NETWORKS: CINCINNATI
Dec. 1969 104 p refs
(PB-194768; APTD-69-16) Avail: NTIS CSCL 13B

Hourly average concentrations of six gaseous pollutants (carbon monoxide, nitric oxide, nitrogen dioxide, sulfur dioxide, total hydrocarbons, and total oxidants), and 2-hour measurements of soiling index levels are tabulated. A brief summary of monthly means and maximums and graphs of seasonal diurnal patterns of gaseous pollutants are included. Annual frequency distributions of the data pertaining to gases and soiling index are tabulated for Cincinnati.
Author (USGRDR)

N71-16745# National Air Pollution Control Administration, Raleigh, N.C. Div. of Air Quality and Emission Data.
THE 1968 DATA TABULATIONS AND SUMMARIES: CONTINUOUS AIR MONITORING PROJECTS: NATIONAL AIR SURVEILLANCE NETWORKS: CHICAGO

Dec. 1969 104 p refs
(PB-194767; APTD-69-15) Avail: NTIS CSCL 13B

Data are tabulated on hourly average concentrations of six gaseous pollutants (carbon monoxide, nitric oxide, nitrogen dioxide, sulfur dioxide, total hydrocarbons, and total oxidants), and 2-hour measurements of soiling index levels in Chicago during 1968. A brief summary of monthly means and maximums and graphs of seasonal diurnal patterns of gaseous pollutants at the Chicago station are included. Annual frequency distributions of the data pertaining to gases and soiling index are presented for all six CAMP stations. Author (GRA)

N71-16761# Air Force Cambridge Research Labs., Bedford, Mass
GEOPHYSICS AND SPACE DATA BULLETIN, VOLUME 7, NO. 2, SECOND QUARTER 1970
Anne L. Carrigan, ed. Sep. 1970 228 p refs
(AD-714412; AFCRL-70-0494; AFCRL-SR-103) Avail: NTIS CSCL 3/2

The Bulletin is a quarterly publication that contains AFCRL contract and inhouse data reported from sites throughout the world. The first four issues, which encompassed 1964 data, constitute Volume I. Volume II (numbers 1-4) contains quarterly data for 1965 with Volume III (1966), Volume IV (1967), Volume V (1968), Volume VI (1969), and Volume VII (1970). Program descriptions for all data sections are updated annually or as required, and are presented in Number 1 of each volume. The following types of data are contained within each issue: magnetometer, cosmic ray, ELF noise, riometer, solar optical and radio emission, and ionosonde. The issue covers such data for April, May, and June 1970. Author (GRA)

N71-16796 Michigan Univ., Ann Arbor.
ON A MULTI-LAYER ANALYSIS OF ATMOSPHERIC DIABATIC PROCESSES AND THE GENERATION OF AVAILABLE POTENTIAL ENERGY
George Edward Lawniczak, Jr. (Ph.D. Thesis) 1969 126 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 70-4127

Using Lorenz' definitions, the volume integration of the covariance between the deviations of the diabatic processes and temperature from their isobaric area mean values is used to calculate the intensity of the general circulation of the atmosphere. A seven-layer quasi-nondivergent model is used to compute the net effect of the diabatic processes within each layer. The data are the daily objective height analyses for the Northern Hemisphere for March 1963. The surface area contained within the analyses extends from about 20N to the pole. Utilizing the simplified vorticity and the full thermodynamic equations, the lower boundary processes and the accumulated vertical changes in the total derivative (horizontal) of the geostrophic potential vorticity are used to calculate the diabatic effects. Effects of variable terrain height and surface friction are included. Static stability is assumed to be pressure dependent. Dissert. Abstr.

N71-16797 Brigham Young Univ., Provo, Utah.
LARGE SCALE GEOMAGNETIC ACTIVITY AND THE DIRECTION OF THE INTERPLANETARY MAGNETIC FIELD
Le Roy Edison Sievers (Ph.D. Thesis) 1969 85 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 70-4723

Interplanetary magnetic field data obtained from Mariners 2, 4, and 5 during the first two months of each flight are studied to determine relationships between the interplanetary magnetic field direction and large scale geomagnetic activity. High geomagnetic activity is found to occur equally often with north pointing and south pointing fields. Considering data from all three flights, geomagnetic activity appears to be nearly independent of the north–south direction of the interplanetary field. This result implies that proposed mechanisms relating interplanetary parameters to geomagnetic activity which depend on a southward pointing field are not correct. Dissert. Abstr.

N71-16798 Michigan Univ., Ann Arbor.
AN ATOMIC OXYGEN BEAM SYSTEM FOR THE INVESTIGATION OF MASS SPECTROMETER RESPONSE IN THE UPPER ATMOSPHERE
Hasso Bernhard Otto Niemann (Ph.D. Thesis) 1969 237 p
Avail: Univ. Microfilms: HC $10.80/Microfilm $3.00 Order No. 70-4155

An atomic oxygen beam system has been designed and tested for the laboratory evaluation of mass spectrometers used in upper atmospheric measurements. The atomic oxygen is generated by thermal dissociation of molecular oxygen on the surface of a tungsten filament heated to 2800 K. A symmetrical bidirectional beam is produced to permit simultaneous monitoring of the particle flux in the beam while target experiments are being conducted. Flux levels of 5 × 10 to the 14th power particles/sq cm sec over a cross-sectional area of 1 sq cm have been produced with a relative atomic oxygen concentration of 70%. At flux levels below 10 to the 13th power particles/sq cm sec, relative atomic oxygen concentrations of more than 90% were obtained. The oxygen beam is of high purity and free from chemically active contaminants. Strong chemical and cryogenic pumping are used to reduce background gas contributions to less than 1%. Dissert. Abstr.

N71-16799 Wisconsin Univ., Madison.
ANISOTROPIC TURBULENCE AND STOCHASTIC ARRAYS OF THREE DIMENSIONAL SCATTERERS IN THE SIMULATION OF TRANSHORIZON TROPOSPHERIC PROPAGATION
Paul Frank Duvoisin (Ph.D. Thesis) 1969 153 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 69-16952

The turbulence theory approach and a deterministic scattered approach to troposcatter propagation are examined. Atmospheric turbulence is described in terms of anisotropic space correlation functions having concentric ellipsoidal loci of constant correlation. Generalized techniques allowing the positional dependence of scattered power to be evaluated for any set of correlation distances, anisotropy orientiation, and correlation function are developed and illustrative examples are presented. Experimental data evidencing positional dependences of scattered power in agreement with the anisotropic turbulence theory are reviewed. A general technique for obtaining the expression for the scattered voltage caused by a refractive blob having concentric ellipsoidal loci of constant refractivity is developed and examples are presented. Dissert. Abstr.

N71-16820*# California Univ., Berkeley. Space Sciences Lab.
MEASUREMENT OF THE WORLDWIDE IONOSPHERIC ELECTRIC FIELD ON BALLOONS Final Report, 12 May 1969–30 Nov. 1970
F. S. Mozer 12 Nov. 1970 9 p refs *Its* Ser. No. 11, Issue 81
(Contract NAS9-9502)
(NASA-CR-114818) Avail: NTIS CSCL 04A

Fabrication and flights of 24 balloon payloads to measure ionospheric and atmospheric electric fields from six sites in Canada, and to analyze the data thereby obtained are reported. A summary of the number of hours of usable data obtained from each flight is given. Ninety-two percent of the launches obtained useful data and the total of 371 hours of data collected represented more than 70% of the amount of data that would have been collected if all flights had been perfect. Author

N71-16898# Lockheed Missiles and Space Co., Palo Alto, Calif.
INVESTIGATION OF THE PASSAGE OF VERY LONG RADIOWAVES THROUGH EARTH'S IONOSPHERE ON THE KOSMOS-142: PRELIMINARY RESULTS
V. A. Makarov et al [1970] 8 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 8, no. 4, 1970 p 571–577
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Preliminary results are presented of an experimental investigation of the passage of radio waves emitted by ground-based radio stations at the frequencies 16.1, 31.85 and 42.85 kHz. Peculiarities of making the measurements and their apparatus assurance are examined. The experimental data obtained are compared with results of theoretical computations. Author

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N71-15772# Joint Publications Research Service, Washington, D.C.
SOVIET AND BULGARIAN PHOTOGRAMMETRIC TECHNIQUES
4 Dec. 1970 25 p refs Transl. into ENGLISH from Geodez. i Kartograf. (Moscow), v. 14, no. 6, 1969 p 38–46, v. 14, no. 8, 1969 p 44–47; v. 14, no. 10, 1969 p 61–63
(JPRS-51920) Avail: NTIS

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N71-15773# Joint Publications Research Service, Washington, D.C.
ACCURACY IN SIGHTING AND IDENTIFYING POINTS WHEN MEASURING THEIR COORDINATES FROM AERIAL PHOTOGRAPHS
N. M. Filchagin *In its* Soviet and Bulg. Photogrammetric Tech. 4 Dec. 1970 p 1–13 refs (See N71-15772 06-14)
Avail: NTIS

Conditions are investigated under which measurements made on basic aerial photographs, using small and large scales, to find points are satisfied with the highest accuracy. The errors in measuring the coordinates of points are shown to result from the photographs themselves, instrument errors, sighting inaccuracy on photograph points, and misidentification of points. R.B.

N71-15774# Joint Publications Research Service, Washington, D.C.
PROCESSING AERIAL PHOTOGRAPHS ON PHOTOGRAMMETRIC INSTRUMENTS USING ADJUSTABLE VALUES
V. B. Dubinovskiy et al *In its* Soviet and Bulg. Photogrammetric Tech. 4 Dec. 1970 p 14–18 (See N71-15772 06-14)
Avail: NTIS

Using known elements of outer orientation of a pair of aerial photographs for constructing a terrain model and orienting the model relative to the geodetic coordinate system, the aerial photographs and work sheet can be placed into the photogrammetric instrument according to the elements of orientation. Analytical methods of spatial phototriangulation, based on the use of a steorocomparator and electronic computer, are considered. The use of adjustable values makes it possible to change the orientation of the aerial photographs in the photogrammetric instrument. R.B.

N71-15775# Joint Publications Research Service, Washington, D.C.
UNIVERSAL SYSTEM FOR THE AUTOMATIC NUMERICAL CODING OF RESULTS OF PHOTOGRAMMETRIC MEASUREMENTS
P. Zafirov *In its* Soviet and Bulg. Photogrammetric Tech. 4 Dec. 1970 p 19–23 (See N71-15772 06-14)
Avail: NTIS

Two variants of a universal device are described which are capable of translating the information punched on the IBM code into any desired code on a five-, six-, seven-, or eight-line tape. The use of the device permits rapid input of the registered numerical data according to the requirements of different electronic computers and maintains continuity in automatic recording of measurement data. R.B.

N71-15852# Sandia Corp., Albuquerque, N.Mex.
FLUSH-MOUNTED ELECTROSTATIC PROBE IN THE PRESENCE OF NEGATIVE IONS
K. J. Touryan and P. M. Chung Sep. 1970 38 p refs
(SC-RR-70-413-A) Avail: NTIS

The current-voltage characteristics of continuum flush-mounted electrostatic probes are analyzed in the presence of negative ions. It is shown that negative ions suppress the electron saturation current significantly and increase the positive ion saturation slightly. Author (NSA)

N71-15853# Road Research Lab., Crowthorne (England).
A SYSTEM FOR THE MEASUREMENT OF DYNAMIC STRESS AND STRAIN IN REPETITIONAL TRIAXIAL LOADING
M. Ryall and N. W. Lister 1970 12 p refs
(PB-192176; RRL-LR313) Avail: NTIS CSCL 14B

Methods based on the dial gauge used in conventional triaxial testing are unsuited for the measurement of dynamic stress and strain in repetitional triaxial testing. Equipment specially designed for this purpose is described. A thin walled copper-berylium cylinder carrying a four active arm bridge of semi-conductor strain gauges forms the load cell and deformation of the sample is measured by a displacement transducer based on inductance change. Direct reading of the load-deformation cycle is displayed on an oscilloscope in addition to separate registration of load and deformation on a high speed galvanometer recorder. Author (USGRDR)

N71-15900# Brookhaven National Lab., Upton, N.Y.
ELECTROCHEMICAL CARBON METER FOR USE IN SODIUM
F. J. Salzano, L. Newman, and M. R. Hobdell [1970] 43 p refs Supported by AEC
(BNL-14508) Avail: NTIS

The feasibility of an electrochemical carbon meter which

measures the chemical activity of carbon in sodium at temperatures from 600 to 700 C has been demonstrated. The cell has a Na2CO3-Li2CO3 electrolyte and has been shown to respond to the addition of various carbonaceous reagents which were added to the sodium, especially carburized iron. Some tests of a cell with a CaC2-LiCl electrolyte are also reported. The chemical activity of carbon in equilibrium with a 347 SS-sodium system has been measured. The use of the meter to indicate when carburizing or decarburizing conditions exist in the sodium is discussed. Some data on the solubility of carbon in sodium determined with the carbon meter are reported. The meter can be used to measure the concentration of carbon in sodium by making use of solubility data.
Author (NSA)

N71-15923# Army Aviation Systems Test Activity, Edwards AFB, Calif.
FLIGHT EVALUATION AN/APN 191 RADAR ALTIMETER Final Report, Feb. 1968 -Jul. 1970
Gary L. Bender and John R. Burden Sep. 1970 31 p refs
(AD-714638; USAASTA-68-13) Avail: NTIS CSCL 1/4

A flight evaluation of the AN/APN 191 radar altimeter was conducted to determine its accuracy and suitability as a test instrument. The testing consisted of 9.7 flight hours with the altimeter system installed in a UH-1C helicopter. Results show that the AN/APN 191 altimeter system has a large random error and is not as accurate as present altitude determination methods. Therefore, this altimeter is unsatisfactory as a test instrument. The indicator scale and sensitivity were excellent; and the accuracy was not affected by attitude, vertical speed, or airspeed variations.
Author (GRA)

N71-15962* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
WIDE RANGE LINEAR FLUXGATE MAGNETOMETER Patent
James P. Heppner and Harold R. Boroson, inventors (to NASA) Issued 28 Jun. 1966 (Filed 30 Jul. 1963) 6 p Cl. 324-43
(NASA-Case-XGS-01587; US-Patent-3,258,687;
US-Patent-Appl-SN-298799) Avail: US Patent Office CSCL 14B

The development of a wide range fluxgate magnetometer is discussed. The magnetometer measures magnetic field components and presents the intensity of the measured magnetic field in digital form.
NASA

N71-15969* General Electric Co., Schenectady, N.Y.
SUPERCONDUCTIVE ACCELEROMETER Patent
Theodor A. Buchhold, inventor (to NASA) Issued 19 Jul. 1966 (Filed 2 Dec. 1960) 12 p Cl. 73-517 Sponsored by NASA
(NASA-Case-XMF-01099; US-Patent-3,261,210;
US-Patent-Appl-SN-73367) Avail: US Patent Office CSCL 14B

An accelerometer is described which employs a variable force principle to determine the acceleration to which a superconducting body is subjected. The device comprises a body having at least one superconductive surface suspended for movement with respect to a reference position. Electrical means are provided for producing a magnetic flux in a restraining coil that acts against the superconductive surface of the body for restraining it close to its reference position. An electrical pick-up is located adjacent to the body for detecting incipient movement and deriving an electric error signal which is amplified, produces a current that is supplied to the restraining coil of the accelerometer, and is a measure of acceleration.
R.B.

N71-15981# Iowa State Univ. of Science and Technology, Ames.
ELECTRIC COLLECTION TRIALS WITH THE MS-702
B. Blanchard 1969 13 p refs Transl. into ENGLISH from French report Presented at the GAMS Meeting, 18 Dec. 1969 Sponsored by AEC
(IS-Trans-82) Avail: NTIS

An electrical detection system which may be adapted to the characteristics of a spark source mass spectrometer is briefly described.
NSA

N71-15992* Little (Arthur D.), Inc., Cambridge, Mass.
APPARATUS FOR MEASURING THERMAL CONDUCTIVITY Patent
Peter E. Glaser, Igor A. Black, Gustav L. Gustafson, and Herbert E. Soini, inventors (to NASA) Issued 29 Mar. 1966 (Filed 7 Oct. 1963) 8 p Cl. 73-15 Sponsored by NASA
(NASA-Case-XGS-01052; US-Patent-3,242,716;
US-Patent-Appl-SN-314572) Avail: US Patent Office CSCL 14B

A device for measuring thermal conductivity of materials in contact with cryogenic fluids is discussed. The device provides an improved flat plate apparatus in which the sample to be evaluated can be exposed to a wide range of discrete temperatures, and which is flexible in that the atmosphere, thickness of the specimen, and temperatures can be readily and accurately changed and controlled during testing.
NASA

N71-15997# Atomics International, Canoga Park, Calif.
TRANSIT TIME FLOWMETER EMPLOYING NOISE-ANALYSIS TECHNIQUES. PART 2: 2-INCH SODIUM-LOOP TESTS
R. L. Randall 30 Sep. 1970 99 p refs
(Contract AT(04-3)-701)
(AI-AEC-12941) Avail: NTIS

The program consists of development and demonstration tests of a 2 in.-diam transit time flowmeter in 80 F water at flow rates to 15 ft/sec and in sodium at operating temperatures up to 1200 F and flow rates to 10 ft/sec. The transit time flowmeter uses sheathed thermocouples with matched-time response installed on replaceable fin-like sensors at two axial positions in a flow channel to detect in the moving fluid random temperature fluctuations in the range of 0.01 to 1.0 F peak-to-peak. A transit time computer instrument system has been developed to provide a continuous readout of the time for fluid transport between sensors. The transit time flowmeter has applications in accurate measurements of flow rate (velocity) in large sodium loops as a flow calibration technique and in measurements of flow from individual fuel element assemblies in sodium-cooled and other types of reactors.
Author (NSA)

N71-16014* Space Technology Labs., Inc., Redondo Beach, Calif.
APPARATUS FOR FIELD STRENGTH MEASUREMENT OF A SPACE VEHICLE Patent
Stuart G. Forbes, Robert F. Kemp, and John M. Sellen, Jr., inventors (to NASA) Issued 1 Nov. 1966 (Filed 5 Oct. 1962) 8 p Cl. 324-32 Sponsored by NASA
(NASA-Case-XLE-00820; US-Patent-3,283,241;
US-Patent-Appl-SN-228569) Avail: US Patent Office CSCL 14B

A low impedance apparatus is described for measureing electrostatic field intensities in the vicinity of an isolated object. The apparatus may be used to measure the floating potential of space vehicles relative to the ambient plasma through which they travel.
E.C.

N71-16133*# Florida Atlantic Univ., Boca Raton. Dept. of Geography.
INSTRUMENTATION OF IMAGE ANALYSIS AND TELEVISION SIMULATION TECHNIQUES
James P. Latham *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 1 1968 29 p (See N71-16126 06-13)
Avail: NTIS CSCL 14B

Investigating concepts and electronic systems which discriminate and analyze geographic phenomena in imagery resulting from aerial and space sensor operations focused on one of three principal objectives: (1) the acquisition, evaluation, and interpretation of multisensor imagery which by time-series observations record the dynamic seasonal changes of the physical and cultural adaptations within a tropical and monsoonal test site in Florida; (2) the further development and testing of electronic instrumentation techniques that discriminate and sample or measure the geographic distribution of phenomena recorded in imagery and that can thereby provide some techniques for automatic interpretation; and (3) the simulation of orbital television observation of the surface of the earth, in order to study how scale and scan-line rate changes affect the interpretation of geographic patterns in scan-line imagery. Author

N71-16146*# Michigan Univ., Ann Arbor.
INFRARED STUDIES
D. S. Lowe *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 1 1968 17 p (See N71-16126 06-13)
Avail: NTIS CSCL 14B

The use of aerial infrared scanners for thermal mapping and multispectral scanning is advocated. Video signals from multiple detectors can be sampled to determine the spectral distribution of radiation from elements when the aircraft flies low over a terrain. Variation in reflectance with angle can be corrected by correlation with known spectral characteristics of objects and their backgrounds. Infrared imagery for earth resource applications requires a scanner to determine surface temperature on a quantitative basis; dc restoration in ac-coupled imaging systems provides fixed detector responses to sources of known radiance that can be quantified to produce true surface radiance as modified by atmospheric absorption and emission. Tonal distortions in infrared imagery caused by limited dynamic range of the display and/or recording medium are overcome by parallel recordings of data at different gain levels and automatic gain control. G.G.

N71-16148*# California Univ., Berkeley. Forestry Remote Sensing Lab.
PHOTOGRAPHIC STUDIES AND APPLICATIONS OF THE NASA EARTH RESOURCES SURVEY PROGRAM
Robert N. Colwell *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 2 1968 35 p (See N71-16147 06-13)
Avail: NTIS

The various photographic studies performed and the applications found by investigators working on the NASA Earth Resources Survey Program in the fields of agriculture, forestry, and range management are described. Discussed in detail are: agricultural and forestry uses of sequential photography; feasibility of delineating meaningful resource boundaries on space photography; multiband photographic experiments; construction of photointerpretation keys; and preliminary tests of operational feasibility. A.L.

N71-16185*# Michigan Univ., Ann Arbor.
INFRARED STUDIES
D. S. Lowe *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 2 1968 17 p (See N71-16147 06-13)
Avail: NTIS CSCL 14B

The capabilities and limitations of using infrared scanners for thermal mapping and multispectral sensing in the NASA Remote Sensing Aircraft Program are discussed. Some of the advantages of using the relatively complex scanner are: (1) Scanners can operate in any region of the optical spectrum. (2) The electrical signal can be readily transmitted, recorded, analyzed, or processed as needed or desired. (3) The detectors generally have a very large dynamic range, and the detection process is reversible. (4) The sensor is amenable to calibration and can yield quantitative data. (5) Collection of data simultaneously in many wavelength channels is possible. The airborne multispectral instrumentation used at Michigan is described and discussed. A.L.

N71-16186*# Michigan Univ., Ann Arbor.
INFRARED STUDIES
D. S. Lowe *In* NASA. Manned Spacecraft Center Earth Resources Aircraft Program Status Rev., Vol. 3 1968 17 p (See N71-16166 06-13)
Avail: NTIS CSCL 14B

The NASA Remote Sensing Aircraft Program uses infrared scanners for thermal mapping and multispectral sensing. A few aspects of what can or cannot be done with the current scanner instrumentation are discussed. Author

N71-16214# Naval Research Lab., Washington, D.C.
AIRBORNE RADIAC. Progress Report, 1 Jan. – 30 Jun. 1970
Charles W. Peters and M. Odell Rhue Aug. 1970 11 p refs
(AD-713884; NRL-MR-2171) Avail: NTIS CSCL 18/4

The report discusses the design and development of a Flyable Breadboard and an NRL-Breadboard of the Airborne Radiac. Author (GRA)

N71-16252# Air Force Missile Development Center, Holloman AFB, N.Mex.
CALIBRATION AND CHARTING OF THE RAIN SIMULATION FACILITY AT THE HOLLOMAN AIR FORCE BASE TRACK
Hans J. Rasmussen Jul. 1970 32 p refs
(AD-714554; MDC-TR-70-28) Avail: NTIS CSCL 14/2

Some basic considerations governing rain erosion testing on the Holloman AFB Test Track are presented, and the equipment used for generating artificial rain is described to the extent relevant to charting the rain field. Some characteristics governing application of the IITRI rain counter are discussed and the analysis of data obtained by this instrument is outlined. Author (GRA)

N71-16291# RAND Corp., Santa Monica, Calif.
USE OF SC4060-PRODUCED MICROFILM OUTPUT IN PSEUDOCOLOR TRANSFORMATIONS
Jeannine V. Lamar Sep. 1970 10 p refs
(AD-713901; P-4485) Avail: NTIS CSCL 14/5

The human eye can distinguish only about 15 or 20 shades of gray in a complex black-and-white image. If the image is in color, far more distinctions can be made. Thus the representation of black-and-white original material by a chromatic presentation (pseudocolor) permits the eye to more rapidly or accurately interpret the data. This is one of the objectives of the image enhancement research. A computer-generated pseudocolor transformation of a black-and-white image was produced by assigning a chromaticity-luminance in the pseudocolor image to correspond to each shade of gray in the original image. Intermediate black-and-white records called pseudocolor separations were produced, either photographically or by computer. These separations are of varying densities and control the amount of light which falls on the color material during the printing process. Author (GRA)

N71-16378# Naval Training Device Center, Orlando, Fla.
A WIDE ANGLE TV CAMERA PICKUP LENS SYSTEM USING REFLECTIVE OPTICS

Edward F. Kashork Aug. 1970 15 p refs
(AD-714487; NAVTRADEVCEN-1H-182) Avail: NTIS CSCL 17/2

The low transmittance of the wide angle optical probe, in use by NTDC, due to aging of the cement and small aperature, prevented full utilization of the novel TV system. The report documents the development of an optical probe for use as a replacement on an in-house CCTV system, based on an extension of work previously reported in the literature. Experimental effort to extend the field of view was performed. Based on data taken on the completed system an aperature was recommended for operation. Author (GRA)

N71-16433# IIT Research Inst., Chicago, Ill.
A NEW FATIGUE DAMAGE INDICATOR
J. W. Dally and G. A. Panizza 15 Sep. 1970 46 p refs
(Contract DA-31-124-ARO(D)-443)
(AD-714258; AROD-5672-11-E) Avail: NTIS CSCL 14/2

The development of a new concept for fatigue damage sensors is presented. The concept is based on the accumulation of damage in a composite material consisting of a particle filled matrix. The composite material is designed to exhibit an electrical conductivity by properly dispersing a system of conducting particles in a matrix which serves as an insulator. A Single conductor of the composite material attached to the component is exposed to a cyclic strain. The resistance of the composite undergoes a permanent change as the composite itself is damaged during the cycling. This damage induced resistance change in the composite can be related to fatigue damage induced in the component by strain cycling. Author (GRA)

N71-16447*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VERY LONG BASELINE INTERFEROMETER (VLBI) EXPERIMENTS USING ATS-3 AND ATS-5 SATELLITES
J. Ramasastry, P. E. Schmid, Jr., and B. Rosenbaum Nov. 1970 33 p refs Submitted for publication
(NASA-TM-X-65428; X-551-70-432) Avail: NTIS CSCL 14B

A proposal is presented for making Very Long Base Line Interferometer (VLBI) measurements at L-band and C-band frequencies using the ATS-5 and ATS-3 satellites, respectively. The proposed experiments will be performed jointly between GSFC and the Smithsonian Astrophysical Observatory. The specific objective of the proposed experiments is to evaluate the usefulness of the VLBI System as a high precision tracking technique. The system is envisioned not only as a potential tracking technique but also as a technique for the study of station location, polar-motion, continental drift and other geodetic problems. Author

N71-16479# Army Electronics Command, Fort Monmouth, N.J.
PERFORMANCE CHARACTERISTICS OF PORTABLE ATOMIC RUBIDIUM CLOCK AND FREQUENCY STANDARD
Clarence E. Searles and Edward Simon Sep. 1970 21 p refs
(AD-714193; ECOM-3339) Avail: NTIS CSCL 14/2

The performance characteristics of the portable atomic rubidium clock and frequency standard were evaluated by comparing its output frequency with the output frequency of a cesium beam frequency standard. A description of the portable clock and the instrumentation used for the evaluation are discussed. The drift rate associated with all rubidium frequency standards was, in the case of the portable clock, less than 1 x 10 to the minus 11th power/ month. Author (GRA)

N71-16532# Stenislaus State Coll., Turlock, Calif.
CRYOGENIC GRAVITY METER Combined Scientific Reports No. 1-2
Vladimir S. Tuman Jun. 1970 51 p refs
(Contract F19628-68-C-0218)
(AD-714569; AFCRL-70-0449) Avail: NTIS CSCL 14/2

The report describes the progress made towards the design and fabrication of a cryogenic gravity meter intended to have a sensitivity of about 25 millimicrogal. The cryogenic gravity meter consists of two parts--a suspension unit and a detection module. The suspension unit is a cylindrically symmetric superconducting magnet with a large magnetic field and a small magnetic field gradient at its geometrical center which supports a superconducting hollow niobium sphere. The detection module is a Josephson junction magnetometer which detects the magnetic flux change due to the motion of the hollow sphere. A feedback circuit is used to keep the magnetometer phase locked on the motion of the sphere; a portion of the feedback signal is recorded on an analog recorder. The signal on the recorder is directly proportional to the position of the sphere. The analog records obtained from a chart recorder are digitized, then a Fourier transform is performed on the data. The analyzed data indicate that spheroidal oscillations of the earth have been observed with this instrument. Author (GRA)

N71-16545# National Bureau of Standards, Washington, D.C. Radiochemical Analysis Section.
PRELIMINARY STUDY ON THE CHARACTERISTICS AND DESIGN PARAMETERS FOR A MOESSBAUER RESONANT DETECTOR
J. J. Spijkerman, J. C. Travis, P. A. Pella, and J. R. De Voe Jan. 1971 65 p refs
(Contract AT(49-2)-1165)
(NBS-TN-541) Avail: SOD $0.65

Progress in the design and fabrication of a resonant detector for Mossbauer Spectroscopy is described. A review of all of the methods of detection for this spectroscopy and the expected advantages of the resonant detector are presented. If one uses conversion electron detection, considerable enhancement in signal to noise ratio and decrease in linewidth may be realized. Efforts to produce an iron bearing resonant material are described. Author

N71-16561*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPECTRAL-AVERAGING ERROR REDUCTION IN LOW-RESOLUTION SPECTRORADIOMETRY
Donald R. Buchele Washington Feb. 1971 36 p refs
(NASA-TN-D-6131; E-5271) Avail: NTIS CSCL 14B

Analytical methods are presented for reducing the error in the weighted average of a spectrally varying quantity when the weighting function is a spectrum measured by an instrument having low spectral resolution. The error is determined in terms of this resolution; this error increases as the resolution becomes lower. Spectroradiometers of the scanning type and the multiple-filter type are considered. Author

N71-16580# Bendix Corp., Southfield, Mich.
PATTERN RECOGNITION DEVICE WITH ADAPTIVE PREPROCESSING AND CLASSIFICATION Final Technical Report, Nov. 1967 - Aug. 1969
J. M. Idelsohn Wright-Patterson AFB, Ohio AMRL Sep. 1970 73 p
(Contract F33615-68-C-1082)
(AD-714576; BRL-4958; AMRL-TR-70-52) Avail: NTIS CSCL 14/5

A program to investigate the application of bionics techniques to the solution of aerial photography pattern recognition problems has been completed. The investigation included development of a unique circuit which will have application in pattern recognition and trainable system. Called an adaptive filter, this circuit is a band-pass filter which can be trained to adjust its center frequency in

accordance with externally generated training signals. A bank of these filters was incorporated in the preprocessing stage of a breadboard pattern recognition system, and served to extract frequency information from an input video signal. Performance of this system was evaluated for the problem of terrain recognition from single-frame panchromatic aerial photography. The photography was converted to a suitable time-varying video signal by a flying-spot scanner. A training strategy enabled the system to refine its processing operations in order to improve classification performance with time. Successful performance of the system was demonstrated in a series of classification tests involving over 1900 terrain samples. Recognition accuracies ranged from 64.5 percent to 95 percent. GRA

N71-16590*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ON THE DYNAMICS OF SHORT PRESSURE PROBES: SOME DESIGN FACTORS AFFECTING FREQUENCY RESPONSE
Ted W. Nyland, David R. Englund, and Robert C. Anderson Washington Feb. 1971 26 p refs
(NASA-TN-D-6151; E-5752) Avail: NTIS CSCL 14B

Measurements were made of the frequency response of 2.54-cm-long probes with inside diameters of 0.325 and 0.160 cm. The effects on frequency response of variations in probe geometry were also measured. These variations in geometry were designed to permit a simultaneous measurement of time-average pressure and to protect the pressure transducer from particles entrained in the airstream. Measured frequency response showed good correlation with predictions made using the equations of Iberall and of Bergh and Tijdeman. A computer program for calculating the frequency response of a multiple-tube volume system using the equations of Bergh and Tijdeman is presented in an appendix. Author

N71-16611# Naval Postgraduate School, Monterey, Calif.
DEVELOPMENT OF A FLAT FREQUENCY RESPONSE PRESSURE TRANSDUCER SYSTEM
John Michael Lewis, II (M.S. Thesis) Jun. 1970 59 p refs
(AD-714602) Avail: NTIS CSCL 14/2

A theoretical prediction to determine the frequency response of a cascaded remote pressure transducer system has been developed. This prediction was used to find a theoretical configuration which would produce a fairly flat frequency response (1.00 plus or minus 0.05) over a 100 hertz range. Such a configuration would allow cross-correlation of an unsteady, random, low-speed flow field by simple analog methods. The theoretical prediction did not hold true for configurations of three serially connected tubes, but the parameters, namely, transducer volume, tube length, and tube diameter, proved the same trends experimentally that were predicted theoretically. By observing these trends, a solution of 1.00 plus or minus 0.09 over a 95 hertz range was obtained. Author (GRA)

N71-16638*# Naval Research Lab., Washington, D.C.
DEVELOPMENT OF ELECTRONOGRAPHIC IMAGE CONVERTERS FOR FAR-ULTRAVIOLET SPACE ASTRONOMY APPLICATIONS
G. R. Carruthers *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 41-47 (See N71-16631 08-09)
Avail: NTIS CSCL 14B

Problems encountered in the development of the devices, their solutions, and rocket flight test results are discussed. The internal parts of the image converter have a completely open and bare type of electrode structure, necessitating scrupulous cleanliness and a lack of sharp edges to prevent coronas. Among the areas needing attention are the following: use of proper types of connectors and cable terminations; placement of a grounded grid made of tungsten stocking mesh ahead of the film plane between the film and photocathode for eliminating a gas discharge which blackened the film; and the use of a grid to repell positive ions ambient in the ionosphere, and an ion source in the laboratory to simulate the ionospheric ions. The operation of the electronographic image converter is described, and the development of other image converters is mentioned. N.E.N.

N71-16638*# Bendix Corp., Teterboro, N.J. Navigation and Control Div.
THE BENDIX OAO STAR TRACKER HIGH VOLTAGE SYSTEM AND ITS DESIGN CONSIDERATIONS
W. Mitchell *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 59-72 refs (See N71-16631 08-09)
Avail: NTIS CSCL 14B

Design constraints, original and modified systems, and problems associated with discharge are discussed. The original system consisted of a 2-kV dc power supply, high voltage terminations and transmission, and phototube and its resistive divider network. The container was vented to the housing which was vented to the local star tracker ambient. The original design was pressure sensitive as it used an air dielectric. Modifications to allow operation at all pressures consisted of providing stable dielectrics and changes in the following areas: high voltage wire and its terminations, high voltage power supply, phototube base and resistive divider network, and phototube window. Discharge at the phototube window was observed under several different sets of conditions, and tests were made to evaluate the problem and its solutions. It is felt that the solution requires that potentials above the minimum sparking value be removed from the gas, and possible solutions are suggested. N.E.N.

N71-16644*# Biddle (James G.) Co., Plymouth Meeting, Pa.
LOW-LEVEL CORONA DETECTORS
P. H. Reynolds and C. J. Saile *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 117-122 refs (See N71-16631 08-09)
Avail: NTIS CSCL 14B

The problem of the detection of pulse signals in insulation systems resulting from the application of alternating voltage is discussed. Consideration is given to the effect of detection system bandwidth, response, and integration time. Particular emphasis is given to tests on insulation systems which may be considered to have distributed parameters or secondary resonances, rather than those which are lumped or simple 2-terminal specimens. The techniques described which permit accurate measurements on distributed insulation systems are equally applicable to the case where lumped systems are to be tested. Author

N71-16656# Sandia Corp., Albuquerque, N.Mex.
QUARTZ GAUGE TECHNIQUE FOR IMPACT EXPERIMENTS
G. E. Ingram and R. A. Graham Jun. 1970 19 p refs Presented at 5th Symp. on Detonation, Pasadena, Calif., 18-21 Aug. 1970 Submitted for publication Supported by AEC
(SC-DC-70-4932; ONR-DR-163; Conf-700803-7) Avail: NTIS

The experimental techniques and construction processes involved in performing gun experiments to determine the mechanical properties of solids with the Sandia quartz gauge are described. The experimental configurations described include the sample-target gauge configuration, the projectile-gauge configuration and the combination of both of these configurations. Methods of constructing quartz gauges are outlined. The delay circuitry employed to achieve accurate shock-velocity measurements is described along with the techniques employed in controlling alignment between the projectile and target. Typical instrumentation and calibration procedures are detailed. Author

N71-16722# Sandia Corp., Albuquerque, N.Mex.
THERMAL EFFECTS SIMULATING DEVICE FOR PRESSURE TRANSDUCERS
R. G. Newman Sep. 1970 12 p
(SC-DR-70-380) Avail: NTIS

A device capable of impinging rapidly a high heat flux on a transducer diaphragm so that the protective coating on the diaphragm can be evaluated under laboratory conditions is described. Author

N71-16723# Sandia Corp., Albuquerque, N.Mex.
SEMIAUTOMATED, DIGITAL MICROWAVE, IMPEDANCE ANALYZER
R. J. Chaffin and T. E. Gerst Sep. 1970 48 p refs
(SC-RR-7-608) Avail: NTIS

A semiautomated test system designed to take accurate microwave impedance data in the 100 MHz-12.4 GHz range is described. The system produces digitized raw data which is reduced via a computer, and the result is corrected experimental data in a useful format. The paper is intended for readers who have had some experience in microwave impedance measurements. Author

N71-16746*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
ACCEPTANCE TEST, DATA REDUCTION PROCEDURE AND CALCULATION DEFINITIONS USED FOR SEALED, ABSOLUTE, GAGE AND DIFFERENTIAL STRAIN GAGE PRESSURE TRANSDUCERS
31 Aug. 1970 30 p Revised
(NASA-TM-X-66603; GP-564-Rev-1) Avail: NTIS CSCL 14B

The checkout and performance test requirements, and the definitions of calculations for sealed, absolute, gage, and differential strain gage pressure transducers are outlined. The transducing elements are strain gage bridges incorporating standardized millivolt output. The transducer case and pressure cavities are made of corrosion resistant stainless steel. Author

N71-16788# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
AMORPHOUS ALLOY RESISTANCE THERMOMETER FOR LOW TEMPERATURE
C. C. Tsuei and Pol Duwez Oct. 1970 4 p refs
(Contract AT(04-3)-822)
(CALT-822-14) Avail: NTIS

Described is an amorphous alloy resistance thermometer that can cover a wide temperature range (≈ 1.5 to 300 K) with a sensitivity increasing with decreasing temperature. The amorphous alloys of the general composition CrX Pd(80-x)Si-20 where 0 < x < or = to 7, are obtained by rapidly quenching the alloy from the liquid state. The specimens thus obtained are foils. A well-defined minimum in the resistivity vs. temperature curve is observed for all these amorphous alloys. The amorphous alloy resistance thermometer can be made by die-cutting the rapidly-quenched foils into an appropriate shape which would give sufficient voltage output. Author (NSA)

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N71-15726# Technische Hochschule Darmstadt (West Germany). Fakultaet fuer Maschinenbau.
MECHANICS OF LOAD DISTRIBUTION ON SPIRAL-TOOTHED COUPLINGS [DER MECHANISMUS DER LASTVERTEILUNG AN BOGENVERZAHNTEN ZAHNKUPPLUNGEN]
Helmut Benkler (Ph.D. Thesis) Nov. 1969 158 p refs In GERMAN
Avail: NTIS

A fundamental computation method for deriving the load distribution and accordingly the torque transmissibility of curved toothed gear couplings is developed. It is different from existing methods in that next to the normal geometrical parameters, the sum division errors of case and star are also accounted for, assuming a given toothed coupling. ESRO

N71-15805# Bureau of Mines, Rolla, Mo. Metallurgy Research Center.
A NEW HIGH-TEMPERATURE SOFT SOLDER SYSTEM
Alfred E. Schwaneke, Wilbert L. Falke, and Orrin K. Crosser Dec. 1970 20 p refs
(TPR-29) Avail: Issuing Activity

A new high-temperature soft soldering system has been developed for use on copper, copper alloys, and low-carbon steel; the method is applicable to automobile radiators and home appliances. The system uses a unique sacrificial metal coating method to promote spontaneous wetting and spreading of zinc and zinc alloy solders on metallic substrates. The electroplated or sputtered, sacrificial nickel coating is absorbed by the molten filler alloy during soldering and produces a direct solder-substrate metallic bond. Preliminary measurements on butt joints with copper members give tensile strengths up to 22,000 psi at room temperature using 95 Zn-5 Al alloy as solder. Recrystallization or annealing of the wrought copper joint members is negligible at the soldering temperatures of 450 to 490 C and lower. A list of fluxes and solder alloys is included in the report. Author

N71-15862 Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
NONLINEAR FRICTION IN SERVOMECHANISMS
In its APL Tech. Dig., Vol. 9, No. 5 Jun. 1970 p 13-15 refs
(See N71-15860 06-23)
Copyright. Avail: APL, Johns Hopkins Univ., 8621 Georgia Ave., Silver Spring, Md. 20910: $0.50

To improve performance prediction for arc second tracking in direct-drive servomechanisms, a conventional nonlinear friction model was extended to include elastic deformation effects in the bearings and other friction producing elements of the mount. The developed mathematical model thus retains the nonlinear differential equation for conventional friction, while incorporating a second empirical nonlinear differential equation to represent the elastic deformation. The experimental hardware derived from the mathematical model was used to investigate mount nonlinearities. The steady-state sinusoidal response of the experimental hardware was measured using a servo analyzer to extract the fundamental component of shaft motion. Corresponding data were obtained on the mathematical model using describing function techniques. The results show good correlation between model predictions and measured hardware data over a wide range of torque levels. R.B.

N71-15871* IIT Research Inst., Chicago, Ill. Armour Research Foundation.
SPECTRAL METHOD FOR MONITORING ATMOSPHERIC CONTAMINATION OF INERT-GAS WELDING SHIELDS
Patent
Billy K. Davis, inventor (to NASA) Issued 6 Sep. 1966 (Filed 19

Feb. 1965) 7 p Cl. 219-131 Sponsored by NASA
(NASA-Case-XMF-02039; US-Patent-3,271,558;
US-Patent-Appl-SN-434143) Avail: US Patent Office CSCL 13H

An emission spectroscopy method is described for monitoring inert gas metal arc welding shields for atmospheric and material contamination. The quality of the weld joint is monitored as it is formed and a signal is automatically given when corrective steps are required to maintain the welding within a specific range.
E.C.

N71-15875# Mechanical Technology, Inc., Latham, N.Y.
EXTENDED DURATION TESTING OF A VAPOR LUBRICATED ROTOR-BEARINGS SYSTEM AND DESIGN GUIDE FOR EXTERNALLY-PRESSURIZED VAPOR BEARINGS. VAPOR LUBRICATION TECHNOLOGY Final Report
E. F. Finkin, S. B. Malanoski, and E. B. Arwas Oct. 1970 165 p refs
(Contract AT(30-1)-3839)
(NYO-3839-10; MTI-70-TR-33) Avail: NTIS

A 500 hour duration test was conducted using a 200 lb rotor operating at speeds of 6100, 2600, and 400 rpm, while horizontally supported on two 4 in. diameter, externally-pressurized, steam-lubricated journal bearings and a 7.5 in. diameter, thrust bearing also externally-pressurized and lubricated with steam. A saturated supply at 90 psig was used, and there was no external heating of the bearing regions to superheat the supply. The bearings design was based on earlier work and comprised a dual header arrangement that precludes condensation and steam hammer instability. The operation was completely stable and on a full fluid film. High speed rubs occurred at 6100 rpm, caused by loss of a coating chip from the thrust bearing and edge contacts in a journal bearing, induced by differential thermal expansions. The damage was limited to the contact areas and did not affect either the operation of the restrictor system or other parts of the rotor.
Author (NSA)

N71-15906* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
INTERMITTENT TYPE SILICA GEL ADSORPTION REFRIGERATOR Patent
John Michael Frank Vickers and Ernest Romvary, Jr., inventors (to NASA) Issued 6 Sep. 1966 (Filed 9 Dec. 1963) 9 p Cl. 62-2 Sponsored by NASA
(NASA-Case-XNP-00920; US-Patent-3,270,512;
US-Patent-Appl-SN-329331) Avail: US Patent Office CSCL 13A

A mechanical, adsorption type refrigeration system is described for providing temperature control for spacecraft components. The application of solar radiation is utilized to provide heat for generation of the refrigerant. The system will cycle continuously for an indefinite period and employs a minimum of moving parts exposed to the space environment. It comprises a pair of adsorber-generator vessels mounted on the spacecraft in a manner to present one of their sides to solar radiation input while opposite sides of the vessels are exposed to black sky. It is also particularly adapted for operation in a zero gravity environment since it is not dependent on gravitational forces for operation. The driving force for the refrigerant fluid is derived from the difference in vapor pressures of the refrigerant in the heated and cooled adsorption vessels.
E.M.C.

N71-15918* General Motors Corp., Milwaukee, Wis.
ADJUSTABLE TENSION WIRE GUIDE Patent
Joseph A. Fischer and Henry G. Dombrowski, inventors (to NASA) Issued 24 Jan. 1967 (Filed 31 Jul. 1963) 4 p Cl. 140-123 Sponsored by NASA
(NASA-Case-XMS-02383; US-Patent-3,299,913;
US-Patent-Appl-SN-299042) Avail: US Patent Office CSCL 13I

A wire winding device is described which is based on the spiral winding of wire on a cylinder. Wire tension is varied by changing the number of turns.
E.C.

N71-15922* General Dynamics/Convair, San Diego, Calif. Astronautics Div.
SEPARATION NUT Patent
Anders R. Jensen, inventor (to NASA) Issued 26 Jul. 1966 (Filed 20 Mar. 1964) 6 p Cl. 85-33 Sponsored by NASA
(NASA-Case-XGS-01971; US-Patent-3,262,351;
US-Patent-Appl-SN-353645) Avail: US Patent Office CSCL 13E

A contamination free separation nut is described in which the products of combustion generated by the firing of a squib are prevented from entering the atmosphere after separation of the nut. The products of combustion act against a piston to produce the nut separation force; and the products of combustion are retained in the piston chamber after separation. In one version, keys movable with the piston chamber exert the separation force on the nut by cocking the segments, and in another form, the nut segments are pulled off the bolt by a housing member attached to the piston casing. Detailed descriptions and drawings of the device are included.
E.M.C.

N71-15928*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADHESION OF VARIOUS METALS TO A CLEAN IRON (011) SURFACE STUDIED WITH LEED AND AUGER EMISSION SPECTROSCOPY
Donald H. Buckley Washington Jan. 1971 23 p refs
(NASA-TN-D-7018; E-5918) Avail: NTIS CSCL 11F

Adhesion experiments were conducted with various metal single crystals contacting a clean iron (011) surface. All the metals were examined in the clean state and some with oxygen present on their surface. Both LEED and Auger analyses were used to determine the nature of surface changes that took place as a result of adhesive contact. Adhesion to clean iron was observed with all metals and oxygen-covered metal surfaces. With clean metals the cohesively weaker transferred to the cohesively stronger. Chemical activity of the metal also influenced measured adhesive forces. When oxygen was present on the metal surface, adhesive forces could be related to chemical binding energy of the metal to oxygen.
Author

N71-15966* Hughes Aircraft Co., Culver City, Calif.
METHOD OF MAKING SCREEN BY CASTING Patent
Siegfried Hansen, inventor (to NASA) Issued 1 Mar. 1966 (Filed 7 Jan. 1964) 6 p Cl. 22-200 Sponsored by NASA
(NASA-Case-XLE-00953; US-Patent-3,237,253;
US-Patent-Appl-SN-336320) Avail: US Patent Office CSCL 09A

A method is presented for making a screen in which the fineness of the mesh is unlimited and which permits any desired screen thickness regardless of mesh size. The screen is made by positioning a large number of particles in a single layer on a plate, the number of particles corresponding to the number of holes per linear inch desired in the screen. A film or coating of suitable material is applied to the plate and the film partially surrounds the particles. The film and particles are then removed from the plate and placed in a chemical reagent where the particles are dissolved out and only the film with perforations remains.
R.B.

N71-15967* Hughes Aircraft Co., Culver City, Calif.
FLUID FLOW CONTROL VALVE Patent
Siegfried Hansen, inventor (to NASA) Issued 6 Sep. 1966 (Filed 9 Apr. 1963) 5 p Cl. 137-13 Sponsored by NASA
(NASA-Case-XLE-00703; US-Patent-3,270,756;
US-Patent-Appl-SN-271822) Avail: US Patent Office CSCL 13K

A valve is described for controlling the flow of fluids in molecular quantities. The flow control member is constructed of a material such as zeolite or activated alumina, which has a honeycomb structure permitting small molecules to pass through the crystal while blocking larger molecules. The aperture diameters of the valve material can be varied in response to temperature, thus providing flow control according to the size of the molecules. R.B.

N71-15968* General Dynamics/Convair, San Diego, Calif. Astronautics Div.
ZERO GRAVITY SEPARATOR Patent
Alexander D. Rosin and A. Milford Pope, inventors (to NASA) Issued 28 Jun. 1966 (Filed 18 Oct. 1963) 15 p Cl. 55-160 Sponsored by NASA
(NASA-Case-XLE-00586; US-Patent-3,257,780; US-Patent-Appl-SN-317391) Avail: US Patent Office CSCL 13G

An apparatus is described for separating gas from a liquid in which the gas is suspended under zero gravity conditions, and is vented while retaining the liquid. The apparatus is used to vent pressure in a space vehicle fuel tank containing cryogenic material which exists as a two-phase fluid. Prior to being vented, the gas extracts heat from the liquid returned to the containment region to reduce the tendency of the liquid to convert to the double-phase condition. R.B.

N71-15984* Technische Hochschule Hannover (West Germany).
CONTRIBUTION TO THE CLARIFICATION OF COMPLEX VULCANIZATION PROCESSES [BEITRAG ZUR AUFKLAERUNG KOMPLEXER VULKANISATIONSPROZESSE]
Suseno Widjaja (Ph.D. Thesis) 1970 89 p refs In GERMAN
Avail: NTIS

Vulcanization of nitrile rubber by sulfur with a mixture of zinc demethyl dithio carbamidate and zinc dibutyl dithio carbamidate as catalysts was studied as were vulcanizations of nitrile rubber blends with natural rubber or with styrol butadien rubber by sulfur with zinc oxide and zinc diethyl dithio carbamidate as catalysts. Concentration ratios between sulfur and catalysts were kept at levels that allowed for the complete recovery of the dithio carbamidates. Results determined the importance of disulfide formation in vulcanization processes; carbon vulcanizations were not satisfactorily established. Transl. by G.G.

N71-15986* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METHOD OF MAKING A MOLDED CONNECTOR Patent
Wilhelm Angele and Hans G. Martineck, inventors (to NASA) Issued 5 Jul. 1966 (Filed 14 Sep. 1964) 7 p Cl. 29-155.55 Continuation-in-part of US Patent Appl. SN-109789, filed 12 May 1961
(NASA-Case-XMF-03498; US-Patent-3,258,831; US-Patent-Appl-SN-396443) Avail: US Patent Office CSCL 09A

A terminal insert connector for flat electrical cables which is sturdy and easily handled is described. The device also has a low current leakage between the electrical contacts. Detailed descriptions and drawings of the device are included. E.M.C.

N71-16052* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD OF IMPROVING THE RELIABILITY OF A ROLLING ELEMENT SYSTEM Patent
Erwin V. Zaretsky, Richard J. Parker, and William J. Anderson, inventors (to NASA) Issued 26 Jul. 1966 (Filed 8 Feb. 1965) 7 p Cl. 29-148.4
(NASA-Case-XLE-02999; US-Patent-3,262,186; US-Patent-Appl-SN-431235) Avail: US Patent Office CSCL 13I

A method is described for improving the load capacity and fatigue life of rolling-element systems in rockets and missiles. The optimum combination of material hardness and induced compressive residual stress is obtained by heat treating all components of the rolling-element system to the same hardness, and then tempering those components subjected to the most stress cycling one to two points Rockwell C hardness less than the other components. F.O.S.

N71-16075* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
METHOD OF COATING CARBONACEOUS BASE TO PREVENT OXIDATION DESTRUCTION AND COATED BASE Patent
Noel T. Wakelyn and Robert A. Jewell, inventors (to NASA) Issued 2 Aug. 1966 (Filed 28 Nov. 1962) 5 p Cl. 117-69
(NASA-Case-XLA-00284; US-Patent-3,264,135; US-Patent-Appl-SN-240760) Avail: US Patent Office CSCL 11C

Protection of carbon and graphite surfaces from oxidation corrosion is provided by applying a laminated protective coating that undergoes partial oxidation and forms an impermeable barrier for the carbonaceous base. Vapor deposition is used to obtain a nitride coating on the carbon base surface followed by a layer of silicon onto the nitride coating. The nitride-silicon dioxide layer acts as protection for the graphite body since it prevents the formation of gaseous carbon oxides at ablation temperatures. G.G.

N71-16076* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROCESS OF CASTING HEAVY SLIPS Patent
William A. Maxwell and Joseph Douglas, inventors (to NASA) Issued 12 Jul. 1960 (Filed 20 Dec. 1956) 4 p Cl. 25-156
(NASA-Case-XLE-00106; US-Patent-2,944,316; US-Patent-Appl-SN-629759) Avail: US Patent Office CSCL 13H

A process of casting metal ceramic and refractory compound powders is described wherein the powders are formed into a plastic slip and forced into a mold. The resulting casting is frozen and vacuum dried to eliminate the liquid phase. Official Gazette of the U.S. Patent Office

N71-16077* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
METHOD OF COATING CARBONACEOUS BASE TO PREVENT OXIDATION DESTRUCTION AND COATED BASE Patent
Robert A. Jewell and Noel T. Wakelyn, inventors (to NASA) Issued 6 Sep. 1966 (Filed 29 May 1963) 4 p Cl. 117-46
(NASA-Case-XLA-00302; US-Patent-3,271,181; US-Patent-Appl-SN-284266) Avail: US Patent Office CSCL 11C

A flame or plasma spraying method is used to provide protective disilicide coatings for carbon and graphite surfaces as impermeable barriers against erosion and oxidation. Molybdenum is deposited onto the carbon surface and subsequently siliconized to form a layer of molybdenum disilicide by inert gas flow in a high temperature furnace. G.G.

N71-16078* Space Technology Labs., Inc., Redondo Beach, Calif.
HERMETICALLY SEALED EXPLOSIVE RELEASE MECHANISM Patent
David A. Lee, inventor (to NASA) Issued 21 Mar. 1967 (Filed 30 Jun. 1964) 4 p Cl. 89-1 Sponsored by NASA
(NASA-Case-XGS-00824; US-Patent-3,309,961; US-Patent-Appl-SN-379072) Avail: US Patent Office CSCL 19A

An explosively actuated release device is described that is able to transmit high tension loads prior to its operation by a

hermetically sealed mechanism. Thus, no fragments, gases, or contaminants are released during operation. This mechanism can be used safely in an explosive atmosphere or in the close proximity of delicate devices. The release mechanism is contained in a cylinder provided with a pressure chamber into which explosive cartridges are inserted. The pressure chamber is closed off by a diaphragm which contacts a piston mounted to the cylinder. The piston engages the head of a bolt which in turn ignites the explosive cartridge. The resulting pressurization of the chamber exerts the diaphragm and moves the piston outward so that a cable fastened to the opposite end of the device is released rapidly. G.G.

N71-16079* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SEPARATOR Patent
Franklin W. Booth, inventor (to NASA) Issued 4 Oct. 1966 (Filed 4 Oct. 1963) 6 p Cl. 233-11
(NASA-Case-XLA-00415; US-Patent-3,276,679; US-Patent-Appl-SN-314074) Avail: US Patent Office CSCL 13G

A liquid-gaseous separator is described that is capable to operate in zero gravity environments. The device consists of a deflector within a centrifuge which directs materials towards the wall where the heavier or more dense particles are collected. They are then withdrawn from the centrifuge by an impact pump and guided through a pipeline to a storage container. G.G.

N71-16083# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
IMPROVEMENT IN THE METHOD OF THE SURFACE ALLOYING OF REFRACTORY METALS IN ALUMINUM MELTS
P. F. Shulenok 8 Sep. 1970 11 p refs Transl. into ENGLISH from Pokrytiya na Metallakh (Kiev), no. 2, 1968 p 118–123
(AD-714415; FTD-HT-23-523-70) Avail: NTIS CSCL 13/8

Hot-dip calorizing of refractory metals, e.g. Ti, Nb and Mo, in aluminum melts is of special interest considering that the process is carried out at relatively low temperatures over a short period of time without requiring a special shielding atmosphere; the compounds of aluminum with refractory metals - the aluminides - display a marked high-temperature strength. Previously, however, the shortcomings of this process did not warrant its widespread industrial introduction. In this connection, the author describes a technique he employed to apply coatings of molten Al to small laboratory specimens of Ti, Nb and Mo. An intermediate container with the specimens is placed in the bath of molten aluminum for the necessary length of time, whereupon it is removed and transferred to a nearby furnace crucible so that the excess molten aluminum can be shed by gravity. With the aid of this method the effect of various factors such as the preparation of specimen surfaces, the alloying of the aluminum bath with such elements as Si or Be in order to reduce the oxidation of its surface, the melt temperature, etc. could be investigated. It was thus found that the formation of protective coatings of the molten metal on the solid metal involves such processes as wetting, adhesion and sorption. GRA

N71-16219# Army Foreign Science and Technology Center, Washington, D.C.
STRENGTHENING OF MAGNESIUM ALLOYS RICH IN ALUMINUM BY COMBINED ACTION OF PLASTIC DEFORMATION AND HEAT TREATMENT [UPROCHENIE MAGNIEVYKH SPLAVOV, BOGATYKH ALUMINIEM PUTEM SOVMESTNOGO VOZDEISTVIYA PLASTICHESKOI DEFORMATSII I TERMICHESKOI OBRABOTKI]
Z. A. Sviderskaya 22 Sep. 1970 17 p refs Transl. into ENGLISH from the Russian
(AD-714120; FSTC-HT-23-240-70) Avail: NTIS CSCL 13/8

The results of studies on the determination of a more effective method of strengthening aging alloy of the type MA 5, a member of the Mg-Al-Zn-Mn system, are presented. The initial material consisted of hot pressed bars 16mm in diameter. The effect of various conditions of heat and heat plus mechanical treatment on the properties of MA 5 alloy is examined using specimens subjected to quenching and in the hot pressed state. Author (GRA)

N71-16288# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HIGH-SPEED GAS-LUBRICATED JOURNAL BEARINGS
A. N. Bragin et al 15 Sep. 1970 96 p refs Transl. into ENGLISH from the Russian
(AD-713877; FTD-HC-23-606-69) Avail: NTIS CSCL 13/9

The survey briefly describes the operating principles and basic types of modern high-speed bearings (antifriction, magnetic, electrostatic, and gas-lubricated). Design fundamentals are set forth for gas-static and gas-dynamic bearings, and the designs of the machines in which gas-lubricated bearings are used and the materials used to make gas-lubricated bearings are discussed. Author (GRA)

N71-16327# Defense Documentation Center, Alexandria, Va.
BRAZING (INDUSTRIAL PROCESSING SERIES), VOLUME 1: A DDC BIBLIOGRAPHY, OCTOBER, 1966–NOVEMBER 1969
Oct. 1970 82 p refs
(AD-714000; DDC-TAS-70-76-1) Avail: NTIS CSCL 13/8

The bibliography is a compilation of annotated references on brazing in a series of bibliographies on Industrial Processing. Computer-generated indexes for corporate author-monitoring agency, subject, personal author, and contract are included. Author (GRA)

N71-16360# Frankford Arsenal, Philadelphia, Pa. Ammunition Development and Engineering Labs.
THE NATURE AND FORMATION OF THE BOND IN THE EXPLOSIVE BONDING OF METALS
James F. Kowalick and D. Robert Hay Jun. 1970 113 p refs
(AD-714221; R-1966) Avail: NTIS CSCL 13/5

Wave formation in explosive bonding is viewed as a special case of the transition from laminar to a turbulent metal flow regime set up along the collision region between two metal interfaces. Employing a novel semicylinder technique developed specifically for this investigation, dynamic parameters of the process are used to determine Reynolds numbers for dynamic metal flow. These are correlated with conditions for obtaining wavy bonded interfaces between metals, the most desirable type of bonding from the standpoint of obtaining superior mechanical properties. A Reynolds number range of 0.38 to 14.7 is established as a necessary and sufficient criterion for explosive bonding. The explosive bonding mechanism is described by using a viscous flow model for metal under impulsive loading. Results of an analysis using this model are used to predict interfacial appearance along the weld seam. Dimensional analyses are employed to derive empirical relations predicting the onset of waves in terms of gross process parameters and material properties. Author (GRA)

N71-16381*# Battelle Memorial Inst., Columbus, Ohio.
DEVELOPMENT OF ADVANCED FABRICATION TECHNIQUES FOR REGENERATIVELY COOLED THRUST CHAMBER BY THE GAS-PRESSURE-BONDING PROCESS
Final Report, 29 Jun. 1967 – 30 Apr. 1970
A. N. Ashurst, M. Goldstein, and M. J. Ryan 6 Oct. 1970 139 p
(Contract NAS3-10305)

(NASA-CP-72795) Avail: NTIS CSCL 13H

Developed was a new fabrication technique for regeneratively cooled rocket-motor thrust chambers. The technique consisted of assembling a liner, ribs, removable tooling (to form the fluid channels and manifolds), and a spool body, and subsequently bonding them together by hot-isostatic pressing in a gas autoclave. Tooling was removed by selective acid leaching, leaving the thrust chamber as an integral part with complex internal passages. A technique for applying an adherent oxide thermal barrier coating to the surface of the liner was also developed during this program. Author

N71-16454# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

APPLYING THE CONTACT-HYDRODYNAMICS THEORY OF LUBRICATION TO THE STUDY OF MACHINE PARTS

D. S. Kodnir et al 12 Aug. 1970 283 p refs Transl. into ENGLISH from the Russian

(AD-714346; FTD-MT-24-82-70) Avail: NTIS CSCL 13/9

The contemporary state of calculations of the majority of machine parts is characterized by one-sided calculation of contact stresses and deformations with the absence of consideration of the effect of lubrication, or conversely, the effect of lubrication is considered, but deformation of friction surfaces is disregarded. This thematic collection is basically dedicated to the question of development and application of the contact-hydrodynamic theory of lubrication (removed shown one-sidedness) for investigation of the efficiency and service life of various machine parts. The articles included are results of works of a branch of the scientific research laboratory of institute during the last several years. Author (GRA)

N71-16457*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Research and Development Center.

ADVANCED BEARING STUDY. PART 1: MATERIAL SCREENING TESTS Final Report

30 Nov. 1970 103 p refs

(Contract NAS3-7943)

(NASA-CR-72279; PWA-FR-2390-Pt-1) Avail: NTIS CSCL 13I

Several materials that could be used for cages, balls, and races in a cryogenic hydrogen-cooled 110-mm ball bearing were evalutated. This was accomplished using a ball and plate test apparatus, which simulated bearing operation at a DN value of 2.5 × 1,000,000 mm-rpm and a thrust load of 20,000-lb. Three cage lubricant materials (Chemloy 719, Salox M, and Armalon 405-A 116) and two ball and race materials (AISI 440C Steel and Stellite Star J) were evaluated. Initial lubricant testing indicated that Chemloy 719 and Salox M were nearly equal in their performance and superior to the Armalon. The two superior lubricants were tested with various combinations of ball and race materials. The results of these tests indicated that each lubricant performed best with a different combination of ball and race materials. A complete 110-mm bearing was designed, based on the findings of the ball-plate testing. Bearings of this geometrical design will be purchased in two different material combinations: (1) AISI 440C balls and races and Chemloy 719 cage lubricant; (2) Star J balls and AISI 440C races with Salox M cage lubricant. Author

N71-16480# Martin Marietta Corp., Denver, Colo.

CENTER FOR HIGH ENERGY FORMING Quarterly Report

Jimmy D. Mote 1 Oct. 1970 28 p Prepared jointly with Denver Univ.

(Contract DA-19-066-AMC-266(X); ARPA Order 720)

(AD-714215; AMRA-CR-66-05-26) Avail: NTIS CSCL 13/8

The report summarizes results during the period 1July through 30 September 1970: Measurements of dynamic loads on an explosive forming die; application of explosive welding to hardware configurations; flange buckling of explosively formed domes; cylindrical explosive forming dies; explosive forming of domes in vented dies; explosive forming of domes for ground based pressure vessels; the edge pull-in of explosively formed domes; fracture toughness of explosively formed high strength steels; explosive welding; explosive powder compaction; explosive forming of thick walled domes; theoretical studies of explosive energy transfer to a thick walled cylinder using a radial piston; explosive autofrettage of forging dies; explosive thermomechanical processing. Author (GRA)

N71-16487*# Bendix Corp., Teterboro, N.J. Navigation and Control Div.

HYDROSTATIC FLUID BEARING GYRO, VOLUME 2 Final Report

R. J. Sgambati Sep. 1970 102 p refs

(Contract NAS8-24414)

(NASA-CR-102992) Avail: NTIS CSCL 17G

The proposed design is presented for a single degree-of-freedom stabilizing gyro utilizing a re-circulated liquid hydrostatic bearing. The self contained unit combines the desirable characteristics of gas bearing and floated components. One of the most significant features of the unit is its potential for optimum thermal design. The use of liquid instead of gas as the working fluid provides immediate reduction of thermal gradients because of the higher conductivity of the liquid. Smaller bearing gaps and liquid flow yield lower inherent thermal gradients than are found in floated gyros. The results of projected optimization studies are presented together with a comprehensive description and discussion of preliminary tests. D.L.G.

N71-16494*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

INVESTIGATION OF FATIGUE PROBLEM IN 1-MIL DIAMETER THERMOCOMPRESSION AND ULTRASONIC BONDING OF ALUMINUM WIRE

Felminio Villella and Michael F. Nowakowski 30 Nov. 1970 45 p refs

(NASA-TM-64566) Avail: NTIS CSCL 13H

The results of investigations into the failure mode caused by thermal deformation and how it affects bond integrity are presented. Thermal analyses at various working conditions were conducted in actual transistors and analyses with the Scanning Electronic Microscope were performed. Based upon the results of these tests, it was possible to establish to what extent thermal fatigue influences the realiability of transistors using 1-mil aluminum wire thermocompression wedge or ultrasonic bonded. Author

N71-16554*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ADVANCED DESIGN CONCEPTS FOR HIGH SPEED BEARINGS

Herbert W. Scibbe and Erwin V. Zaretsky [1971] 33 p refs Proposed for presentation at 1971 Design Eng. Conf. of the ASME, New York, 19–22 Apr. 1971

(NASA-TM-X-52958) Avail: NTIS CSCL 13I

Advanced rolling-element bearing technology has been developed that has enabled bearing operation to temperatures of 600 F in an inerted environment. Longer fatigue lives than with present day bearing lubricants have been obtained. More than 13 times the AFBMA-predicted (catalog) life was obtained with bearings using AISI M-50 ball and race materials, an AMS 4892 nickel-base steel cage material, and a synthetic paraffinic lubricant at temperatures from 400 to 600 F. A ball bearing design with 50-percent ball weight reduction has been run successfully for short time periods at DN values to 3 million. This concept offers promise of extending bearing fatigue life at high DN values. Author

N71-16555*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS AND COMPUTER PROGRAM FOR EVALUATION OF ROTATING INCOMPRESSIBLY LUBRICATED PRESSURIZED THRUST BEARINGS
David P. Fleming Washington Feb. 1971 28 p refs
(NASA-TN-D-6075; E-5938) Avail: NTIS CSCL 13I

An analysis and FORTRAN IV computer program are presented to enable rapid evaluation of pressurized thrust bearing designs using an incompressible lubricant. Included in the analysis are the effects of two self-acting journal bearings which may be used to provide a radial load capacity. Bearing load, torque, lubricant flow rate, and other quantities of interest are calculated. Either orifice or capillary restrictors may be used and effects of bearing rotation are included. Program input and output can be in U. S. Customary or metric (SI) units. Analytical predictions agreed well with experimental data from a series-hybrid fluid-film rolling-element bearing. Author

N71-16576*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PUMPING CHARACTERISTICS OF A ROTATING TRUNCATED CONE
Sol H. Garland and James C. Wood Jan. 1971 13 p refs
(NASA-TM-X-52953) Avail: NTIS CSCL 13K

Pumping characteristics of a rotating truncated cone having a major diameter of 20.3 cm and a minor diameter of 12.7 cm were determined at speeds up to 30,000 rpm. The surface of the cone had a semi-apex angle of 45 degrees and a constant radial gap of .406 cm. Operating characteristics could be approximated using equations for enclosed rotating disks. Author

N71-16577*# TRW Systems Group, Redondo Beach, Calif.
SEAL MATERIAL DEVELOPMENT PROGRAM, PHASE 1 Final Report
31 Dec. 1970 95 p refs
(Contract NAS9-10481)
(NASA-CR-114822; trw-14771-6001-R0-00) Avail: NTIS CSCL 13E

An investigation was conducted to identify and characterize materials which would advance the state of the art for oxygen-hydrogen propulsion system seals. The temperature range covered was from −423 F to +200 F. A total of nineteen materials were evaluated, with fourteen being tested at least once during the program. Included in the materials tested were Teflon (as the control material), ethylene propylene terpolymer compounds, two silicone compounds, HYSTL (a TRW polyurethane resin), an experimental fluorinated elastomer, and Viton-A. Although the goal of the investigation was to identify a single material for use in both oxygen and hydrogen over the entire temperature range, a number of materials were characterized for use in either oxygen or hydrogen. The experimental fluoroelastomer generally indicated superior performance to other materials for use in both oxygen and hydrogen systems. The Teflon performed satisfactorily in both propellants. Viton A and HYSTL exhibited excellent seal characteristics for use in liquid hydrogen systems. Tests conducted included liquid hydrogen seal tests, LO2 impact sensitivity tests, and cleaning and flushing fluid and elevated temperature exposure tests. Author

N71-16581*# Midwest Research Inst., Kansas City, Mo.
DEVELOPMENT OF LUBRICATING OILS SUITABLE FOR USE WITH LIQUID OXIDIZERS Final Summary Report, 4 Dec. 1968 – 4 Oct. 1970
L. W. Breed and R. L. Elliot Oct. 1970 50 p refs
(Contract NAS8-25510; MRI Proj. 3380-C)
(NASA-CR-103006) Avail: NTIS CSCL 11H

Four-ball wear tests have verified the report that wear properties of bis(polyfluoroalkyl) 3-methylglutarate ester-based greases can be improved through the use of 2 wt. % of tricresyl phosphate as an additive. Wear scar diameters were reduced to 0.38 mm. at 50 kg. when the test was run at 147 F and 600 rpm with 52-100 steel balls. Two grease compositions containing this additive showed no reactions in 20 tests at an impact energy of 10 kg-m in the LOX-compatibility test. A search of the literature indicated that the fluids do not require an additive to counteract oxidation and consequent corrosion at operation temperatures below 300 F. Above 400 F, certain copper salts are known to be effective stabilizers for bis(polyfluoroalkyl) ester fluids. Bis(polyfluoroalkyl) esters of 2-methyl-glutaric acid and 3,3-dimethylglutaric acid have been prepared for LOX compatibility screening as possible alternate fluids with some cost advantage. Author

N71-16622# Utah Univ., Salt Lake City. Div. of Materials Science and Engineering.
CHEMICAL VAPOR DEPOSITION STUDY Annual Progress Report
Oct. 1970 12 p refs Sponsored by ARPA
(AD-714517; UTEC-MSE-70-192) Avail: NTIS CSCL 13/8

A brief summary of the activities over the last six months is presented. Studies range from the deposition kinetics through the production of CVD tungsten tubes to their analysis via X-rays, mechanical property studies and microstudies. GRA

N71-16747# Bendix Corp., Kansas City, Mo.
BORON SHOT GRADING AND INSPECTING
Michael J. Napier Sep. 1970 7 p refs
(Contract AT(29-1)-613)
(BDX-613-155) Avail: NTIS

An inspection system for grading development quantities of boron shot was developed. A wire mesh sieving process is used to size the shot. Compressive strength and chemical composition is determined by standard laboratory techniques. Author

N71-16819# Bendix Corp., Kansas City, Mo.
INFRARED REFLOW SOLDERING
R. W. Hughs Jul. 1970 35 p
(Contract AT(29-1)-613)
(BDX-613-169) Avail: NTIS

Infrared reflow soldering is a method of simultaneously connecting all leads of flatpacks to circuit boards by means of focused radiant heat. Ease of solder control, rework capabilities, and speed are the major benefits of this technique. These advantages prompted the investigation of infrared reflow soldering to determine the feasibility of soldering integrated circuits and hybrids to two-sided circuit boards by this method, and to determine the plating and printed circuit board requirements for optimal application of the process. Research indicates that such a process is impractical for placement of component leads on the circuit pad because of the difficulty in simultaneously positioning all leads on the pad for soldering. Author (NSA)

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N71-16108# Illinois Univ., Urbana. Materials Research Lab.
STUDY AND DEVELOPMENT OF LUMINESCENCE AND LASER OPERATION IN VARIOUS 3-5 AND 2-6

SEMICONDUCTORS Final Report, 1 Feb. 1969 – 31 May 1970
Nick Holonyak, Jr. Wright-Patterson AFB, Ohio AFML Jul. 1970 57 p refs
(Contract F33615-69-C-1334)
(AD-714533; AFML-TR-70-149) Avail: NTIS CSCL 20/5

Carrier recombination and laser processes in semiconductors, mainly GaAs, are described. Measurements on GaAs over a wide doping range are reported. The electron-hole-lattice interaction and its 16meV reduction of the laser photon energy in GaAs is ascribed in large part to electron-electron interaction. Laser operation of p-n junctions in GaAs doped with amphoteric impurities is demonstrated. Optical pumping with a Ga(AsP) laser diode has been used to excite photoluminescence and laser operation of n+/n/n+ layered structures, and to perform spectroscopic studies on Gunn oscillator wafers. A method is described for coupling laser beams into thin structures (about one micrometer) and for easy coupling of optical signals between various thin structures. Author (GRA)

N71-16215# United Aircraft Corp., East Hartford, Conn. Research Labs.
MODE-LOCKING OF AN ATMOSPHERIC PRESSURE CROSS-EXCITED ELECTRICALLY PULSED CO2 LASER
David C. Smith and Paul J. Berger Oct. 1970 13 p refs
(Contract N00014-69-C-0308)
(AD-714023) Avail: NTIS CSCL 20/5

Self-mode-locking of a cross-excited electrically pulsed CO2 laser has been observed and studied as a function of cavity length and operating pressure. The best results are achieved with a 2.2 meter cavity having an active length of 1.5 meters. At a pressure of 450 Torr three axial modes are locked to give a train of 5 nsec pulses. Shorter pulses on the order of 2-3 nsec are seen at higher pressures, but the modulation and pulse shape are not as reproducible. With longer cavities more axial modes are locked, resulting in a longer dead time between pulses; however, the pulse widths increase. This indicates that less of the bandwidth is utilized with closely spaced axial modes. Author (GRA)

N71-16574*# Hughes Research Labs., Malibu, Calif.
LUNAR SURFACE HOLOGRAPHY EXPERIMENT INSTRUMENT FEASIBILITY DEMONSTRATION Final Report, 27 Jul. – 30 Nov. 1970
D. H. Close Dec. 1970 66 p refs
(Contract NASw-2092)
(NASA-CR-116146) Avail: NTIS CSCL 20E

A prototype portable holocamera was fabricated using a mode-controlled, pulsed, ruby laser. An automatic sequence of four holograms is recorded of each object. The prototype holocamera and playback system were tested by recording and studying holograms of various objects, including resolution test charts and diffusely reflecting surfaces composed of fine, low contrast grains. Single holographic images of resolution charts show resolution to 4 micrometers. Specular point resolution is approximately 1.8 micrometer, and edge detail shows intermediate resolution that can be as good as 2 micrometers. Author

N71-16668# California Univ., Santa Barbara. Dept. of Physics.
IODINE FLUORESCENCE EXCITED BY THE HE-NE 6328-A LASER
K. Sakurai and H. P. Broida 16 Apr. 1970 4 p refs Submitted for publication
(Contract N00014-69-A-0200-8004; ARPA Order 125)
(AD-714531; TR-35) Avail: NTIS CSCL 7/4

Iodine fluorescence excited by the 6328-A neon line of a helium-neon laser has been reported. Hanes and Dahlstrom, using fluorescence spectroscopy, suggest that the transitions are the P(33) rotation line of the 6-3 vibration band and the R(127) line of the 11-5 band in the B triplet Pi(Ou)(t) - X singlet Sigma (g)(t) transition of I2. The authors report definite support for the assignments of Hanes and Dahlstrom by comparisons between the observed laser-induced fluorescence of I2 and the calculated Franck-Condon factors. Author (GRA)

N71-16834# Sylvania Electronic Systems-West, Mountain View, Calif.
TEN MICRON WIDEBAND DETECTOR Annual Report
Joel Falk and J. M. Yarborough 1 Nov. 1970 31 p refs
(Contract N00014-70-C-0224; ARPA Order 306)
(AD-713995) Avail: NTIS CSCL 9/5

The report, a summary of results obtained during the first six months of the program, is organized in the following manner: Section 2 describes the properties of proustite applicable to frequency conversion techniques and summarizes the results of a theoretical investigation of parametric upconversion of CO2 radiation to the near infrared. Section 3 describes CO2 and Nd:YAG experimental mixing efforts. Section 4 details a theoretical investigation of thermal imaging including a discussion of expected upconverted power and resolution. Author (GRA)

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N71-15750# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
COMPILATION OF THE MECHANICAL PROPERTIES OF DILUTE (5 PERCENT MAXIMUM) ALLOYS OF URANIUM
V. C. Hemperly 22 Sep. 1970 67 p
(Contract W-7405-eng-26)
(Y-DA-3618) Avail: NTIS

A data listing of U alloys compiled from technical progress reports issued by the Oak Ridge Y-12 Plant through October 1969, and from unpublished data (designated ABT) is presented. All of the data represent alloys prepared and tested at Y-12, and the compilation was prepared to facilitate surveying the available information concerning dilute (5% max) alloys of uranium. Each block of mechanical property data is followed by the available information that characterizes the test materials. The number of the technical progress report from which the information was taken follows the narrative. Because these tests were made only to survey properties in a particular area of interest, the alloy systems have not been evaluated extensively. The headings designate the process step that was under examination at the time of testing. Author (NSA)

N71-15751# Georgetown Univ., Washington, D.C. Dept. of Physics.
A STUDY OF VERY PURE METALS AT LOW TEMPERATURES Progress Report
[1970] 116 p refs
(Contract AT(40-1)-3665)
(ORO-3665-23) Avail: NTIS

In the process of searching for a slight depression of the super-conducting critical temperature (Tc) in gallium alloyed with small amounts of indium and rapidly frozen to 77 K, it was found that no superconducting transition existed near the gallium transition of 1 K. Instead, the data (primarily ac susceptibility measurements) indicated two possible superconducting transitions, one at 4 to 6

K and one above 25 K. Moreover, the transition above 25 K could be shifted with magnetic field H so that H was propertional to Tc squared, just as one would expect for a superconductor. Because of the importance of a high-Tc superconductor, efforts were concentrated on proving (or disproving) that these transitions were indeed due to superconductivity. A series of specific heat, dc magnetization, and resistivity measurements were done. The results of these experiments, as well as the progress in other areas, are summarized under the following subjects: the transition at 25 K, the transition at 4 to 6 K, tunneling studies, boundary scattering studies, and theoretical work. NSA

N71-15850# Naval Research Lab., Washington, D.C.
DYNAMIC TEAR TEST INVESTIGATIONS OF THE FRACTURE TOUGHNESS OF THICK-SECTION STEEL
F. J. Loss 20 Jan. 1970 54 p refs
(NRL-7056; HSSTP-TR-7) Avail: NTIS

The effect of mechanical constraint imposed by thick sections was examined in the framework of linear elastic fracture mechanics (LEFM) and other temperature-transition indices. Extrapolation of thin-section LEFM data to higher temperatures raised the concern that thick-section steels, of shelf toughness and strength class similar to A533-B, will not exhibit a brittle-to-ductile transition with increasing temperature. Research programs relating to thick dynamic tear test studies and to thick LEFM investigations show that unirradiated A533-B exhibited a significant increase in toughness within a relatively narrow temperature region near the nil ductility transition temperature. Size effects studies indicate that the effects of mechanical constraint associated with thick sections elevated the fracture transition-elastic temperature (the temperature at which very large flaws remain dormant up to yield stress) for 12-in.-thick sections approximately 70 F above the FTE temperature for thin sections, which in turn is 60 F above the NDT temperature. Author (NSA)

N71-15886# Maryland Univ., College Park.
EFFECT OF NEUTRON DAMAGE ON THE DISLOCATION DYNAMICS OF bcc METALS AND SOLID SOLUTIONS AT LOW TEMPERATURES
R. J. Arsenault and E. Pink 1970 13 p refs Presented at the 2d Intern. Conf. on the Strength of Metals and Alloys, Pacific Grove, Calif., 30 Aug. - 4 Sep. 1970
(Contract AT(40-1)-3612)
(CONF-700819-3) Avail: NTIS

Single crystals and polycrystalline samples of V, V-Ti, and Mo with various interstitial impurity levels were irradiated. The yield and flow stress were measured at various temperatures and strain rates, and slip parameters were also determined. The irradiation effects on the thermal component of the flow stress is found to be influenced by the amount of impurity interstitials; no change results from a high interstitial concentration. For intermediate interstitial ranges (100 to 300 ppM), a reduction in the thermal component can result due to interstitial trapping by the radioinduced defects, but for this to occur, the interstitials have to be the rate-controlling barrier to dislocation motion. For low interstitial concentration, the thermal component is increased in those bcc metals with a low activation energy of deformation. Alloying additions obscure these effects. NSA

N71-15887# California Univ., Berkeley. Lawrence Radiation Lab.
METASTABLE AUSTENITES: DECOMPOSITION AND STRENGTH
W. W. Gerberich, G. Thomas, E. R. Parker, and V. F. Zackay Aug. 1970 6 p refs Presented at 2d Intern. Conf. on the Strength of Metals and Alloys, Pacific Grove, Calif.
(Contract W-7405-eng-48)
(UCRL-20308; CONF-700819-1) Avail: NTIS

The stress-strain properties of metastable austenites, including Luders strain and the strain hardening rate, are quantitatively predicted. This is accomplished by invoking the rule of mixtures, the relationship between the volume of strain-induced martensite, strain and austenite stability, and an empirical description of austenite stability in terms of composition and processing variables. Author (NSA)

N71-15888# Ohio State Univ. Research Foundation, Columbus.
STRESS CORROSION CRACKING OF Fe-Cr-Ni ALLOYS IN CAUSTIC ENVIRONMENTS, 15 OCTOBER 1969 - 14 JANUARY 1970
1970 37 p
(Contract AT(11-1)-2018)
(COO-2018-11) Avail: NTIS

Results from stress corrosion and electrochemical studies are reported for Fe-Cr-Ni alloy exposed to NaOH-H2O solutions at temperatures below 200 C. Stress corrosion studies show intergranular-transgranular transitions as the alloys and applied potentials are varied. The electrochemical studies show that increasing temperature causes the protective films to dissolve more rapidly. Also the addition of chromium to Fe-Ni appears to be deleterious to the general corrosion resistance. Author (NSA)

N71-15889*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MASS SPECTROMETRIC KNUDSEN CELL STUDIES OF VAPORIZATION OF LANTHANUM AND SCANDIUM CARBIDES AND DISSOCIATION ENERGY OF LaC2, LaC3, LaC4, ScC2, AND ScC4
Fred J. Kohl and Carl A. Stearns Washington Jan. 1971 30 p refs
(NASA-TN-D-7039; E-5865) Avail: NTIS CSCL 20L

The vaporization of the lanthanum-carbon and scandium-carbon systems was studied over the temperature ranges 2267 to 2600 K, respectively. Experimentally determined reaction enthalpies were used to derive dissociation energies for the molecular metal dicarbides and tetracarbides. The atomization energy of lanthanum tricarbide was determined to be 1759 + or - 31 kJ/mole. The heat of formation of solid lanthanum dicarbide was calculated as -89 + or - 24 kJ/mole. For the lanthanum-carbon system, vapor pressures were also determined. Author

N71-15890*# General Electric Co., Cincinnati, Ohio. Nuclear Systems Programs.
ADVANCED REFRACTORY ALLOY CORROSION LOOP PROGRAM Quarterly Progress Report, 15 Apr. - 15 Jul. 1970
R. W. Harrison and J. P. Smith 12 Aug. 1970 53 p refs
(Contract NAS3-6474)
(NASA-CR-72782; GESP-546; QPR-21) Avail: NTIS CSCL 11F

The program for the fabrication, operation and posttest evaluation of the T-111 Rankine System Corrosion Test Loop is reviewed. Included are the fabrication and evaluation of a 1900 F lithium loop, the advanced tantalum alloy tests, and the results of chemical analysis of specimens of T-11 alloy containment tubes. F.O.S.

N71-15901# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
LOW CYCLE, STRAIN CONTROLLED FATIGUE CRACK PROPAGATION IN NUCLEAR PIPING STEELS
A. J. Brothers Jun. 1970 102 p refs
(Contract AT(04-3)-189)
(GEAP-10181) Avail: NTIS

Crack growth rates under reversed tension-compression strain controlled loading were measured for both the axial and bending mode for A-212B carbon steel, 2-1/4 Cr-1 Mo, and Type 304 stainless steel at room temperature. Both through-cracked, center-slotted plates and surface-cracked specimens were employed for axial loading, and a surface-cracked specimen for bending tension-compression; these latter specimens were also tested at 550 F. All results are correlated with the nominal total strain range and, where applicable, with the stress intensity factor, K. A method is proposed for correlating geometry effects for low cycle, strain controlled fatigue. Author (NSA)

N71-15902# California Univ., Berkeley. Lawrence Radiation Lab.
POSITRON ANNIHILATION IN METALS AT VERY HIGH PRESSURES
John L. Przybylinski (Ph.D. Thesis) Aug. 1970 127 p refs
(Contract W-7405-eng-48)
(UCRL-19647) Avail: NTIS

The angular correlation of gamma rays from positrons annihilating with electrons in metals can be used to study the momentum distribution of conduction electrons in a metal. This method was used in the study of aluminum, bismuth, and ytterbium, at pressures up to 100 kilobars. Aluminum yielded unexpected and only partially explained results, which are thought to be associated with the state of strain of the aluminum specimen. The bismuth results were in agreement with the free electron model. The results on ytterbium provided confirmatory evidence of a proposed promotion of an electron from a 4f state to a 5d conduction band at high pressures. Surprisingly, the promotion appears to take place before the phase transition from fcc to bcc at 40 kbar. Ytterbium in the fcc phase above 20 kbars, therefore, cannot be considered to be a semiconductor unless the 5d electrons are considered as core electrons for the purpose of conductivity. The Moessbauer effect of Dy-161 in gadolinium metal at very high pressures was measured. Author (NSA)

N71-15930# Atomics International, Canoga Park, Calif.
STRESS-RUPTURE BEHAVIOR OF TYPES 304 AND 316 STAINLESS STEEL CLADDING IN HIGH TEMPERATURE STATIC SODIUM
D. F. Atkins 30 Sep. 1970 77 p refs
(Contract AT(04-3)-824)
(AI-AEC-12976) Avail: NTIS

Thin-walled seamless tubing, fabricated from single heats of each alloy, were tested over the range of 900 to 1400 F. This tubing was supplied with 10 to 15% cold work, and the long-term performances of the cold-worked alloys were compared with annealed material from the same heats. In addition to cold-work effects, special tests were conducted to evaluate the influence of test environment (sodium vs helium) and stress mode (unaxial, 2:1 biaxial, and 1:1 biaxial) on the stress-rupture behavior of the two alloys. The strength benefits of cold work were found to be dependent on test temperature and degree of cold working. If the temperature was such that recovery processes occurred in the cold-worked alloy, the long-term strength was inferior to that of annealed material. Increasing the degree of cold work was found to enhance the rate of cold-work recovery. Author (NSA)

N71-15931# Ohio State Univ. Research Foundation, Columbus. Dept. of Metallurgical Engineering.
STRESS CORROSION CRACKING OF Fe-Cr-Ni ALLOYS IN CAUSTIC ENVIRONMENTS Quarterly Report, 16 Jul. - 14 Oct. 1969
Roger W. Staehle 18 May 1970 26 p refs
(Contract AT(11-1)-2018)
(COO-2018-8) Avail: NTIS

Stress corrosion tests have been run on commercial stainless steels in boiling 50% NaOH solutions. Resistance to cracking of wire specimens is shown to be proportional to the content of nickel plus chromium. Anodic polarization curves have been determined over a range of NaOH concentrations and for specially prepared alloys in the composition range of stainless steels. All alloys appear to persist in the passive range at room temperature although the anodic current increases as the NaOH concentration increases. Author (NSA)

N71-16009# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INFLUENCE OF VOLUME FRACTION OF FIBER ON THE CYCLIC STRENGTH OF A COPPER-TUNGSTEN COMPOSITE MATERIAL
G. A. Deryagin et al 27 Aug. 1970 12 p refs Transl. into ENGLISH from Fiz. I. Khim. Obrabotki Materialov (USSR), no. 1, 1969 p 117-121
(AD-714753; FTD-HT-23-476-70) Avail: NTIS CSCL 11/4

It is shown that copper, reinforced with tungsten fiber to a volume fraction of 10 percent and more, possesses high resistance to fatigue breakdown at room temperature; with a volume fraction of fiber equal to 37 percent the fatigue limit rose from 8 to 32 kgf/sq cm. The high resistance of the composite to fatigue breakdown is caused by an increase in the energies of formation and propagation of cracks in metals and alloys reinforced with high-strength fibers. Author (GRA)

N71-16025* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH TEMPERATURE COBALT-BASE ALLOY Patent
John C. Freche, Richard L. Ashbrook, and Gary D. Sandrock, inventors (to NASA) Issued 4 Oct. 1966 (Filed 15 Jun. 1964) 4 p Cl. 75-170
(NASA-Case-XLE-02991; US-Patent-3,276,865; US-Patent-Appl-SN-375401) Avail: US Patent Office CSCL 11F

A high-temperature cobalt-base alloy is described which is resistant to corrosion by liquid metals and to sublimation in a vacuum environment. The alloy is workable and weldable to permit forming into sheets of tubing for ducting applications. R.B.

N71-16026* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NICKEL-BASE ALLOY CONTAINING Mo-W-Al-Cr-Ta-Zr-C-NB-B Patent
John C. Freche and William J. Waters, inventors (to NASA) Issued 4 Oct. 1966 (Filed 14 Apr. 1964) 3 p Cl. 75-171
(NASA-Case-XLE-02082; US-Patent-3,276,866; US-Patent-Appl-SN-360180) Avail: US Patent Office CSCL 11F

A nickel-base alloy is described which is claimed to have resistance to oxidation at elevated temperatures and sufficient ductility to facilitate fabrication of the alloy into sheet products. The alloy can be cast without closely controlled vacuum techniques while retaining superior high temperature and stress-rupture properties. R.B.

N71-16033# Naval Research Lab., Washington, D.C. Reactor Materials Branch.
DEMONSTRATION OF IMPROVED RADIATION EMBRITTLEMENT RESISTANCE OF A533-B STEEL THROUGH CONTROL OF SELECTED RESIDUAL ELEMENTS
J. Russell Hawthorne 19 May 1970 35 p refs
(Contract AT(49-5)-2110)
(AD-714166; NRL-7121) Avail: NTIS CSCL 11/6

The primary objective of special melt specifications and melt planning was the reduction of copper and phosphorus contents to the lowest possible level. Restrictions were also imposed on the content of other residual impurity elements with known or suspected influences on radiation embrittlement resistance. For a broad experimental analysis, the melt was split to provide material representing the primary melt analysis (0.03% Cu) and a melt modification (0.13% Cu). Plates representing each analysis were also split and sections individually heat-treated to Class 1 or Class 2 strength conditions. All procedures used were standard mill practices. Radiation assessments showed the primary melt analysis to have very low sensitivity to radiation embrittlement at 550F (288C). Author (GRA)

N71-16044* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

METHOD FOR ETCHING COPPER Patent

Stanley P. Kovell and John B. Schutt, inventors (to NASA) Issued 6 Oct. 1970 (Filed 24 Nov. 1967) 4 p Cl. 156-3; Int. Cl. B44c1/22; Int. Cl. C23f

(NASA-Case-XGS-06306; US-Patent-3,532,568; US-Patent-Appl-SN-685473) Avail: US Patent Office CSCL 11F

Copper is etched from a surface by contacting the surface with an acidic solution of ferric ion which is reduced to the ferrous valence state. Substantial concentration of ferric ion is maintained in the solution by oxidizing ferrous ion produced during the etching with oxygen in the presence of ultraviolet light. Official Gazette of U.S. Patent Office

N71-16220# Aerospace Corp., El Segundo, Calif. Lab. Operations.

THE EFFECTS OF PROCESSING ON PLASTIC STRAIN ANISOTROPY OF Ti-6-Al-4V Research Report, Jan. – Oct. 1969

Maurice F. Amateau, Dennis L. Dull, and Louis Raymond Los Angeles SAMSO 25 Sep. 1970 22 p refs

(Contract F04701-70-C-0059)

(AD-714562; TR-0059(6250-10)-5; SAMSO-TR-70-380) Avail: NTIS CSCL 11/6

The plastic strain anisotropy of Ti-6Al-4V was examined after various thermomechanical treatments, including heat treating, rolling, and forging. The processing temperatures were varied from room temperature to 1950F. The anisotropy, in terms of the strain ratio R, was measured by post-yield strain gages in the three principal directions. The results were correlated with the (0002) pole figures for each thermomechanical treatment. The plastic strain anisotropy, which was consistent with the basal pole texture, was found to depend upon both the method and the temperature of mechanical working. The greatest R values occurred for the cold-rolled material where the sheet normal rotates to within 15 deg from the basal pole. In addition, R is not constant under uniaxial tension but generally increases with the amount of plastic strain. The variation of R with uniaxial strain depends upon the forming temperature, with the largest changes occurring in samples that were rolled at room temperature. Author (GRA)

N71-16255# Army Foreign Science and Technology Center, Washington, D.C.

CHANGE IN PROPERTIES DURING AGING OF ALUMINUM ALLOYS [ZAKONOMERNOSIT IZMEHEHIYA SVOYSTV PRI STARENII ALYUMINIYEVYKH SPLAVOV]

I. N. Fridlyander 22 Sep. 1970 16 p refs Transl. into ENGLISH from Russian report

(AD-713921; FSTC-HT-23-236-70) Avail: NTIS CSCL 11/6

According to A. A. Bockvar, the type of heat treatment based on the processes of a dissociation of a state of an alloy fixed by hardening, is called annealing or aging. During artificial aging in distinction to natural aging not only are the processes of dissociation of the supersaturated solution accelerated but another structure and a different complex of mechanical and physical properties of the alloys appear. When increasing the duration of the artificial aging or when increasing the aging temperature above the conditions, which lead to maximum hardness there occurs a lowering of the hardness and a creep limit, and elongation increases insignificantly or doesnt change remaining at a comparatively low level. Author (GRA)

N71-16260# Los Alamos Scientific Lab., N.Mex.

SMOOTHING EFFECTS OF SURFACE TENSION ON GROOVED MELT WIRES

B. J. Thamer May 1970 11 p refs

(Contract W-7405-eng-36)

(LA-4458)

Possible interference of scratch smoothing in detecting melting of cylindrical, grooved melt wires has been investigated theoretically and experimentally. Isotropy has been assumed for surface tension and coefficients. The rate of diagonal build-up of material in the bottom corner of the groove below the melting point has been calculated from known transport processes. The higher-order terms omitted in Mullins' original treatment of scratch smoothing have been retained in solving the differential equation by the method of finite differences. Other methods of solution also are discussed. The time required to give objectionable build-up (> 1 mil) is calculated to be 2 days for vacuum-sealed zinc, 3 months for vacuum-sealed silver, 8 months for copper encased in graphite, 4 yr for nickel in graphite, and 5 months for platinum in graphite. The calculation is supported by experimental observations for silver. Author (NSA)

N71-16311# Army Foreign Science and Technology Center, Washington, D.C.

MACRO- AND MICRODEFORMATION AT Mo AND Mo-Re POLYCRYSTALS IN UNAXIAL EXTENSION [MAKRO- I MIKRODEFORMATISIYA POLIKRISTALLOV MO I Mo-Re PRI ODNOOSNOM RASTYAZHENII]

M. A. Gezalov et al 23 Oct. 1970 10 p refs Transl. into ENGLISH from Fiz. Metal. Metalloved. (Sverdlorsk), v. 28, no. 3, 1969 p 542 – 544

(AD-714086; FSTC-HT-23-1127-70) Avail: NTIS CSCL 11/6

The curves of extension of the crystals lattice (microdeformation) obtained by X-ray defraction measurements, and of the entire specimen (macrodeformation) of Mo and Mo-Re polycrystals are compared, whereas the micro and macrodeformation coincide for Mo in the elastic region, microdeformation of Mo-Re alloy drags notably behind macrodeformation through the entire range of stresses. Possible causes of heterogeneity in deformation of the MO-Re alloy are examined. Certain features of deformation of Mo in the plastic region are revealed and explained. Author (GRA)

N71-16328# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CORROSION INHIBITORS IN THE SYSTEM LIQUID HYDROCARBONS-AQUEOUS SOLUTIONS

V. F. Negreev et al 21 Aug. 1970 21 p refs Transl. into ENGLISH from Tr. 3d Tretyego Mezhdunarodnogo Kongressa Korrozii Metallov, 1966 (Moscow), v. 2, 1968 p 82 – 89

(AD-714419; FTD-MT-24-164-70) Avail: NTIS CSCL 11/6

The results of various kinds of experiments carried out with various inhibitors proved that their action in mixtures of water and liquid hydrocarbons depends on their adsorption on the metal surface and making it hydrophobic. This facilitates the formation of protective hydrocarbon films on the surface and results in a

decrease in corrosion. An increase in temperature of such a system decreases corrosion. Some inhibitors, however, act by diminishing of electrode corrosion processes. Author (GRA)

N71-16329# Illinois Univ., Urbana. Dept. of Metallurgy and Mining Engineering.

ON THE DISLOCATION MOBILITY IN GERMANIUM AT HIGH STRESSES AND LOW TEMPERATURES

Robert P. Walson and Howard K. Birnbaum 30 Sep. 1970 10 p refs

(Contract N00014-67-A-0305-0016)

(AD-714267) Avail: NTIS CSCL 20/12

The motion of dislocations in germanium at 300K was studied at very high stresses. No evidence was found for any dislocation motion at stresses up to tau/G = 0.017. Both grown-in and freshly introduced dislocations were studied using etch pitting techniques. The results are shown to be consistent with the thermally activated kink model and to be in disagreement with the predictions of the kink tunneling model proposed by Gilman. Author (GRA)

N71-16330# Battelle Memorial Inst., Columbus, Ohio.

FRACTURE AND FATIGUE-CRACK PROPAGATION CHARACTERISTICS OF 7075-T7351 ALUMINUM ALLOY SHEET AND PLATE Final Report, 24 Mar. 1968–31 Oct. 1969

Charles E. Feddersen and Walter S. Hyler 15 Mar. 1970 151 p refs

(Contract N00156-68-C-1344)

(AD-714019; G-8902) Avail: NTIS CSCL 11/6

The program was directed to provide information relative to damage tolerance of panels of 7075-T7351 sheet and plate. This implied the generation and analysis of information on flat panels containing centrally located flaws and testing, either under monotonically increasing load or under cyclic loads. The information obtained provided insight into the two major aspects of damage tolerance - residual strength and fatigue-crack propagation - from tests on panels ranging in thickness from 1/16 inch to 1 inch and in width from 8 inches to 36 inches. The program has shown that there are at least two bench marks in crack growth behavior from the monotonically increasing load test: (1) onset of slow growth at which a flaw initially present begins to grow slowly with increasing load, and (2) critical instability at which unstable and rapid crack growth occurs that results in failure. From the data obtained a generalized residual strength analysis was developed which identifies a fracture toughness property for thin and transition thickness materials as well as presents design data and fracture or residual strength predictions for structural applications. The program has also resulted in the identification of an empirical expression that appears to be quite useful in predicting fatigue-crack propagation and the remaining lifetime of a panel containing a fatigue crack. Author (GRA)

N71-16343# Rutgers Univ., New Brunswick, N.J. Materials Research Lab.

DEPENDENCE OF FATIGUE LIFE AND FLOW STRESS ON THE MICROSTRUCTURE OF PRECIPITATION-HARDENED Al-Cu ALLOYS Summary Report, 1-30 Jun. 1970

B. K. Park, V. Greenhut, G. Luetjering, and S. Weissman Wright-Patterson AFB, Ohio AFML Aug. 1970 58 p refs

(Contract F33615-70-C-1240)

(AD-714085; AFML-TR-70-195) Avail: NTIS CSCL 11/6

The fatigue and flow stress properties of polycrystalline and single crystal specimens of the Al-3 wt % Cu alloy and of commercial Al2024 alloy were investigated as a function of heat treatment. In order to obtain significant information regarding the interaction of the moving dislocations with the precipitate particles, the specimens were fatigued in push-pull at a constant stress corresponding to 0.5% initial plastic strain. Particular attention was focused upon the dependence of fatigue life of this alloy on size and distribution of the precipitate particles (interparticle distance) and their coherency with the matrix. Author (GRA)

N71-16352# California Univ., Berkeley. Lawrence Radiation Lab.

FRACTURE CHARACTERISTICS OF METASTABLE AUSTENITIC STEELS UNDER CYCLIC LOADING

Govind Ram Chanani Jul. 1970 183 p refs

(Contract W-7405-eng-48)

(UCRL-19620) Avail: NTIS

The behavior of a class of metastable austenitic steels, called Trip steels, under cyclic loading was investigated. The alloy composition was chosen to have the M sub s well below room temperature and the M sub D above room temperature after thermo-mechanical processing. Both high-strain low cycle experiments on round and well-polished specimens, as well as fatigue crack propagation (fcp) tests on specimens at various stress-intensity range (DeltaK) levels were carried out. To study the effect of a mixed austenite-martensite matrix, low cycle fatigue tests were also done on the Trip steel after inducing fresh martensite by a very high prestrain. To establish the role played by the martensite transformation, tests were also run at 200 C, which was above M sub D. It was found that the low cycle fatigue life of Trip steels both at room temperature (in the presence of martensitic transformation) and at 200 C (in the absence of the transformation) were related to the plastic strain range, epsilon sub PR, by the Coffin-Mason law. Either cyclic hardening or softening occurred at room temperature depending primarily upon the epsilon sub PR used in cycling. Hardening was observed for epsilon sub PR greater than approximately 3%, while softening occurs below 3% epsilon sub PR. Author

N71-16353# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.

MOBILITY OF BASAL DISLOCATIONS INTERACTING WITH NON BASAL DISLOCATIONS IN ZINC

Norio Nagata and T. Vreeland, Jr. 1970 5 p refs Presented at 2d Intern. Conf. on the Strength of Metals and Alloys, Pacific Grove, Calif.

(Contract AT(04-3)-767)

(CALT-767-P-3-11; CONF-700819-2) Avail: NTIS

The effect of dislocations on the mobility of basal dislocations in zinc was studied. It is shown that dislocation velocity is a linear function of stress, and the equation for determining the critical shear stress for the motion of dislocation is given. Results are compared to theoretical predictions. F.O.S.

N71-16354# Oak Ridge National Lab., Tenn.

THE ANNEALING OF QUENCHED-IN VACANCIES IN THE Al-Zn ALLOYS AND ITS INFLUENCE ON THE KINETICS OF THE COARSENING PROCESS OF GUINIER-PRESTON ZONES

Volkmar Gerold et al Oct. 1970 14 p refs Transl. into ENGLISH from Z. Metallk. (West Germany), v. 61, 1970 p 102–107 Sponsored by AEC

(ORNL-tr-2375) Avail: NTIS

The Ostwald ripening (particle coarsening) of nearly spherical Guinier-Preston zones was studied in an Al-Zn alloy at room temperature by X-ray small angle scattering after various quenching treatments. The ripening process is related with the annealing-out of vacancies. The density and size of dislocation loops was investigated by transmission electron microscopy. From the annealing-out of vacancies a diffusion coefficient D sub L for vacancies was estimated which is of the order of 10 to the −12th

power sq cm/sec. This value was found to be much too small to explain the Ostwald ripening for which a value of the order of 10 to the −8th power sq cm/sec seems to be necessary. The discrepancy can be explained by the assumption that the zinc-bound vacancies do not anneal out at dislocation loops. If this is taken into account a value of 10 to the −8th power sq cm/sec for the diffusion coefficient of vacancies is not in contradiction to the annealing-out kinetics. A small addition of Magnesium changes the diffusion process markedly. Author

N71-16368# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.

MAGNETIC PROPERTIES OF AN AMORPHOUS Mn-P-C ALLOY

Ryusuke Hasegawa Nov. 1970 12 p refs

(Contract AT(04-3)-822)

(CALT-822-15) Avail: NTIS

The magnetic properties of an amorphous Mn75P15C10 alloy obtained by rapid quenching from the liquid state and those of the crystalline alloy of the same composition were measured. The results are interpreted by assuming that the amorphous alloy consists of three different regions (called phases for simplicity) in which the local atomic arrangements are different. One of these phases has a local order based on crystalline Mn3P. The other two phases cannot be described in detail but might be based on the structure of one of several crystalline Mn carbides. Evidence is shown that the antiferromagnetic Neel temperature of an amorphous alloy is reduced to about 1/2 of that of the corresponding crystalline alloy. By using the molecular field analysis present results show that the magnetic interactions are less localized to the first nearest neighbors in the amorphous Mn3P phase than in the crystalline phase. Author

N71-16382# Air Force Systems Command, Wright-Patterson AFB, Ohio. Materials Lab.

THE EFFECTS OF STRAIN-RATE AND STRAIN-RATE HISTORY ON THE MECHANICAL PROPERTIES OF SEVERAL METALS Summary Report, Aug. 1968 − Apr. 1969

Theodore Nicholas and Jack N. Whitmire Aug. 1970 6 p refs

(AD-714086; AFML-TR-70-218) Avail: NTIS CSCL 11/6

Constant and variable strain-rate test data are reported for 1100-0 and 1199-0 aluminum, AISI 1020 steel, and commercially pure 50-A titanium in shear. Torsion tests on thin-walled tubes covering a range in shear strain-rates from 0.0001 to 25/sec. up to 10 percent strain show that pure aluminum shows very little rate sensitivity while steel and titanium are noticeably rate sensitive. Variable rate tests show that subsequent dynamic loading on a statically prestrained specimen causes an increase in the flow stress in steel and a decrease in the flow stress in titanium. Author (GRA)

N71-16383# Pennsylvania State Univ., University Park.

CONCERNING THE EFFECT OF NON-HYDROSTATIC STRESSES UPON THE CHEMICAL POTENTIAL OF AN INTERSTITIAL SOLUTE IN SOLID SOLUTIONS Final Report, 16 Feb. 1966 − 15 Aug. 1970

George Simkovich and William R. Bitler 1970 4 p ref

(Contract DA-31-124-ARO(D)-432)

(AD-713866; AROD-6061-3-MC) Avail: NTIS CSCL 11/6

An evaluation was made of a thermodynamic theory which states that an alloy under uniaxial elastic stress will show increased concentrations of interstitial constituents in solid solution when the stress is tensile and a decrease in the concentration of the interstitial under compressive stress, as compared to a stress-free system when the thermodynamic activity of the interstitial is kept constant at a constant temperature. Author (GRA)

N71-16390# Michigan Technologocial Univ., Houghton. Dept. of Metallurgical Engineering.

EFFECT OF ANNEALING ON THE SUBSTRUCTURE OF COLD WORKED fcc METALS AND ALLOYS Technical Progress Report, 1 Sept. 1969 − 1 Sep. 1970

D. E. Mikkola, D. J. Borich, and C. L. Rase Sep. 1970 22 p refs

(Contract AT(11-1)-1431)

(COO-1431-9; TPR-6) Avail: NTIS

The annealing behavior of Cu-based solid solutions and of Cu3Au were investigated. Samples of alpha-Cu-8.5 at.%Ge alloys deformed by explosive loading were studied, and preliminary measurements of microhardness, electrical resistance, microstrains, stacking fault probability, and substructure are discussed. The ordering behavior of off-stoichiometric compositions in Cu3Au alloy system were also studied, and hardness measurements of the recrystallization behavior of Cu3Au near the critical temperature are described. A computer program for analysis of X-ray diffraction data is mentioned. N.E.N.

N71-16393* Boeing Co., Seattle, Wash.

METHOD OF INHIBITING STRESS CORROSION CRACKS IN TITANIUM ALLOYS Patent

Theodore R. Beck, inventor (to NASA) Issued 22 Sep. 1970 (Filed 30 Sep. 1968) 5 p Cl. 21-2.7; Int. Cl. C23f11/06 Sponsored by NASA

(NASA-Case-NPO-10271; US-Patent-3,529,928; US-Patent-Appl-SN-763869) Avail: US Patent Office CSCL 11F

A method is described to prevent stress corrosion cracking in titanium alloys exposed to various fluids. The method involves adding extremely small amounts of oxyanions, generally in the form of soluble salts, to the liquids to be in contact with the titanium alloy. The oxyanions used could include phosphates, chromates, nitrates, and carbonates. The amount of the additive is usually determined by the amount of chloride, bromide, or iodide ions present in the fluid composition. It is stated that the addition of these compounds to the fluid material serves to completely inhibit the stress corrosion of the titanium alloys. D.L.G.

N71-16436# Army Foreign Science and Technology Center, Washington, D.C.

EFFECT OF COMBINED DEFORMATION AND HEAT TREATMENT ON PROPERTIES OF ALUMINUM ALLOYS

M. Kh. Rabinovich 24 Sep. 1970 21 p refs Transl. into ENGLISH of the book "Vlnyaniye Sovmeschennoy Deformatsionno-Termicheskoy Obrabotki Na Svoystva Alymminiyevykh Splauov" Moscow, Nauka Press, 1968 p 102−114

(AD-713979; FSTC-HT-23-237-70) Avail: NTIS CSCL 13/8

The effects of combined treatment on the properties and structure of a broad class of alloys are investigated. The results of tests indicate that combined treatment has a negative effect on alloys in the freshly annealed state. The hardness of alloys after deformation at the temperature of normal hardening with subsequent rapid cooling was less than that of the same alloys after only quenching. Author (GRA)

N71-16437# Naval Research Lab., Washington, D.C.

COMPUTATIONAL METHOD FOR CHEMICAL COMPOSITION BY X-RAY FLUORESCENCE ANALYSIS. THE PURE STANDARD PROGRAM EMPLOYED ON COPPER-SILVER BINARY ALLOYS Interim Report

T. R. Tucker 30 Sep. 1970 8 p refs

(AD-713936; NRL-7180) Avail: NTIS CSCL 11/6

A program has been developed to analyze the interelement effects in x-ray fluorescence data for alloys and homogeneous

mixtures. Chemical analysis is thereby possible using either a standard of known composition or a set of pure-element standards. The program was tested on copper-silver binary alloys. The agreement was excellent for the silver calculation but unacceptable for copper. However, the copper calibration agreed with an independent computer calculation from a different source. These results indicate that the data may be improved in subsequent work. Author (GRA)

N71-16438# Army Foreign Science and Technology Center, Washington, D.C.

SPECIFICS OF THE PRODUCTION TECHNOLOGY OF INGOTS AND SEMI-FINISHED PRODUCTS OF CORROSION RESISTANT 4201 TITANIUM ALLOYS [OSOBENNOSTI TEKHNOLOGII PROIZVODSTVA SLITKOV TITANOVYKH SPLAVOV TIPA 4201]

N. F. Anoshkin et al 23 Sep. 1970 15 p refs Transl. into ENGLISH from the publ. 'Lighweight Alloys and Their Treatment Methods' Moscow, Izd. Nauka, 1968 p 247–254

(AD-714065; FSTC-HT-23-242-70) Avail: NTIS CSCL 13/8

As a result of these investigations, the specifics of the technological properties of the alloys were determined, pilot scale technology was developed for the production of the ingots and semi-finished products, the regularities of changes of the structure and properties of the alloys as a function of deformation modes and heat treatment were studied, and the corrosion behavior of commercial semi-finished products was studied in certain corrosive media. Author (GRA)

N71-16451# Boeing Co., Renton, Wash. Commercial Airplane Div.

QUANTITATIVE TEXTURE ANALYSIS BY X-RAY DIFFRACTION

R. H. Olsen 24 Sep. 1970 46 p refs

(AD-713985; D6-25265) Avail: NTIS CSCL 20/2

Techniques have been developed to quantitatively plot pole figures using x-ray diffraction. Corrections are made for background and defocusing effects and the data is converted from angular coordinates to orthogonal coordinates using stereographic mapping equations. The x-ray data is taken using a modified Siemens Pole Figure Goniometer and plotting is done via CDC 6600 and SC 4020 processing. Calculation of an anisotropy index (K sub A) is made from the basal plane pole figures of titanium and empirically related to mechanical properties. Author (GRA)

N71-16485# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.

THE MECHANICAL EFFECTS OF A DISPERSION OF A SECOND PHASE

M. F. Ashby Sep. 1970 39 p refs Presented at 2d Intern. Conf. on the Strength of Metals and Alloys, Asilomar, Calif., Aug. 1970

(Contract N00014-67-A-0298-0020)

(AD-714173; TR-3) Avail: NTIS CSCL 13/8

The review of the effects of a dispersion of discrete particles on the mechanical properties of crystals considers models at two levels: (a) the continuum or quasi-continuum level and (b) the microscopic or atomistic level. The simpler continuum approach yields upper or lower bounds for the flow stress or strain rate. In many cases (e.g. work hardening) this is the best we can do at present. Other properties (e.g. the yield stress and the inhibition of diffusional creep by particles) can only be explained by microscopic models. Author (GRA)

N71-16498*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTAL BIAXIAL CREEP DATA FOR TANTALUM, MOLYBDENUM, AND ALLOYS T-111, TZM, AND TZC

William L. Maag and William F. Mattson Washington Feb. 1971 26 p refs

(NASA-TN-D-6149; E-5822) Avail: NTIS CSCL 11F

Experimental, biaxial steady-state creep data for tantalum, T-111, molybdenum, TZM, and TZC are presented. The tests were conducted on internally pressurized thin-wall tubes. The biaxial creep data were analyzed using the von Mises criterion for plastic flow. The data, in terms of effective stresses and strain rates, were compared with uniaxial data of other investigators and the results were equivalent. Creep-rate correlations for each material are presented. Author

N71-16504*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AN EVALUATION OF THE SLURRY COMPACTION PROCESS FOR THE FABRICATION OF METAL-MATRIX COMPOSITES

Thomas L. Bales and Ronald L. Cain Washington Feb. 1971 37 p refs

(NASA-TN-D-6107; L-7344) Avail: NTIS CSCL 11D

A fabrication process for producing metal-matrix composites, designated the slurry compaction process, was developed and evaluated. The process consists of wet-winding filaments through a slurry consisting of a metal powder suspended in a solution of an acrylic resin and organic solvents, drying of the wound composite, and compaction by hot-pressing. Using the slurry compaction process, composites consisting of a pure aluminum matrix reinforced with 26 to 62 percent (by volume) uniaxially alined beryllium filaments of 130-micrometers (0.005-in.) diameter were fabricated. Reasonable agreement was obtained between the results of tensile and compression tests and rule-of-mixtures predictions. Test results were also compared with those obtained from commercially produced composite specimens fabricated by diffusion bonding. The buckling strength of slurry-compacted composite plates was compared with orthotropic plate theory. The slurry compaction process is considered promising if the problem of filament degradation can be alleviated. Author

N71-16579# United States Steel Corp., Monroeville, Pa. Applied Research Lab.

UNIDIRECTIONALLY SOLIDIFIED WROUGHT STEEL ARMOR Final Technical Report, 6 Mar. 1969–5 Jun. 1970

C. E. Bieniosek 1 Sep. 1970 84 p refs

(Contract DAAG46-69-C-0056)

(AD-714294; AMMRC-CR-70-21) Avail: NTIS CSCL 19/4

Prior work showed that superior-quality homogeneous wrought steel armor plate could be produced from 240-pound unidirectionally solidified slab castings. The work reported here indicated that scaling up from 240- to 500-pound castings did not impair the ballistic properties of plates produced from these castings. Optimum ballistic properties were obtained in 3/4-inch-thick homogeneous plates rolled from unidirectionally solidified castings that were produced from a clean, vacuum-melted steel containing 0.45 to 0.50 percent carbon. Homogenization treatment resulted in better ballistic performance than did no homogenization. Plates rolled from unidirectionally solidified steel had higher merit ratings than did equivalent plates rolled from conventionally solidified ingots. The highest velocity merit rating obtained in this program was 1.44, but that homogeneous plate fractured. Dual-hardness plates produced from unidirectionally solidified steel did not show an improvement in ballistic properties comparable to the improvement experienced with homogeneous plates. Lack of a strong bond between the front and back plates significantly impaired the ballistic performance of the dual-hardness plates. Author (GRA)

N71-16698# Westinghouse Electric Corp., Madison, Pa. Advanced Reactions Div.

STAINLESS STEEL CLADDING DEVELOPMENT Quarterly Progress Report, Period Ending 30 Jun. 1970
William E. Ray Aug. 1970 49 p refs
(Contract AT(30-1)-4135)
(WARD-4135-12) Avail: NTIS

In work devoted to evaluation of austenitic stainless steel, microcharacterization and mechanical property testing, including biaxial tensile, biaxial stress rupture, and both uniaxial and biaxial creep were continued on ARD vacuum melted materials. Comprehensive characterization, including texture evaluation, was completed for two lots of planetary swaged tubing and the results were compared with plug drawn material. Biaxial tensile testing at room temperature and five elevated temperatures was completed on four tubing lots, completing the biaxial tensile testing planned for the vacuum melted steels program. Results were compared for the evaluation of the effects of the independent variables on the properties of tubing. Thirty-eight stress rupture tests were completed, and longer term tests are continuing. The results from seven lots of material representing various combinations of the independent variables were compared. Classification of the mode of rupture of post-test biaxial stress rupture specimens continued. Author (NSA)

N71-16699# Maryland Univ., College Park.
SOLID SOLUTION WEAKENING OF bcc SOLID SOLUTIONS
D. F. Hasson and R. J. Arsenault 1970 11 p refs Presented at the 2d Intern. Conf. on the Strength of Metals and Alloys, Pacific Grove, Calif., 30 Aug.–4 Sep. 1970
(Contract AT(40-1)-3612)
(CONF-700819-4) Avail: NTIS

In order to determine if the mechanism of solid solution weakening is scavenging or reduction of Peirls' stress, an internal friction study was made on Ta–2 at. % W, Ta–9.2 at. % Nb, and V–1.31% Ti alloys containing oxygen interstitials. The results show no scavenging in the first two alloys, while Ti scavenges the oxygen interstitials in V. NSA

N71-16717# Maryland Univ., College Park.
INVESTIGATION OF IRRADIATION STRENGTHENING OF bcc METALS AND SOLID SOLUTIONS Progress Report, Jan. 1970–Oct. 1970
Oct. 1970 7 p refs
(Contract AT(40-1)-3612)
(ORO-3612-7) Avail: NTIS

Results of postirradiation investigations of annealing mechanisms in V are reported that show there is no change in the effective stress due to anneal at 200 C. Other data are included associated with the trapping ability of neutron-induced defects. These data are presented graphically to show the ratio of internal friction at 0 peak temperature in annealed and irradiated V as function of interstitial oxygen distribution. NSA

N71-16727# Dayton Univ. Research Inst., Ohio.
CONTENT MAPPING TECHNIQUES FOR QUALITATIVE AND SEMIQUALITATIVE ANALYSIS WITH THE ELECTRON MICROBEAM PROBE Technical Report, Oct. 1969–May 1970
James S. Solomon and W. L. Baun (AFML) Wright-Patterson AFB, Ohio AFML Sep. 1970 28 p ref
(Contract F33615-69-C-1330)
(AD-714567; AFML-TR-70-146) Avail: NTIS CSCL 14/2

Content mapping of small surface areas with the electron microbeam probe can be used to quickly obtain very effectively both qualitative and quantitative information. An automatic content mapping device is available with the Hitachi Perkin-Elmer XMA-S Electron Probe Micro-analyzer that can cover an area up to 50 microns by 50 microns. Compared with the conventional X-ray image, advantages of content mapping include enhancement of the contrast of the element density distribution for specimens having an enriched element density with slight variation and for specimens under high magnification with poor contrast. The content mapping device is described and examples of content maps of various alloy-composition and concentrations are shown. Author (GRA)

N71-16778# Illinois Univ., Urbana.
EFFECT OF HIGH PRESSURE ON SELF-DIFFUSION IN BETA-TITANIUM
Rondo Nelden Jeffery (Ph.D. Thesis) Oct. 1970 88 p refs
(Contract AT(11-1)-1198)
(COO-1198-749) Avail: NTIS

Diffusion of Ti44 into beta-titanium has been measured as a function of pressure at approximately 1000 C using standard lathe-sectioning techniques. The diffusion coefficient is found to decrease with pressure, indicating a positive activation volume. This result is in contradiction of earlier reports of negative activation volumes for diffusion of Fe in beta-Ti and U in gamma-U. Author (NSA)

N71-16779# Iowa State Univ. of Science and Technology, Ames.
STUDY OF SOME HEXANUCLEAR MIXED-METAL CLUSTER COMPOUNDS CONTAINING TANTALUM AND MOLYBDENUM
John Louis Meyer (Ph.D. Thesis) Oct. 1970 78 p refs
(Contract W-7405-eng-82)
(IS-T-402) Avail: NTIS

Three new mixed-metal cluster compounds containing tantalum and molybdenum were prepared and characterized by their electronic spectra, far infrared spectra, and magnetic properties. The compounds, derivatives of the Ta6Cl12(n+) clusters, were formulated as (R4N)2.3[(Ta5MoCl12)Cl6] and (R4N)2[(Ta4Mo2Cl12)Cl6]. Author (NSA)

N71-16781# Illinois Univ., Urbana.
SECOND AND THIRD ORDER ELASTIC CONSTANTS OF MAGNESIUM
Edwin Roland Naimon Sep. 1970 87 p refs
(Contract AT(11-1)-1198)
(COO-1198-756) Avail: NTIS

The complete set of the ten third order elastic constants of magnesium has been determined experimentally from measurements of the hydrostatic pressure and uniaxial compression derivatives of the natural sound velocities using a variation of the pulse superposition technique. The specimen was neutron irradiated to suppress dislocation effects. A theoretical model was developed to predict the elastic constants of magnesium. The energy density of the metal consisted of a volume-dependent term, an electrostatic term, and a band structure term which was derived from pseudopotential theory. The pseudopotential used was the local one proposed by Ashcroft and used by Suzuki, et al. in calculating the elastic constants of cubic metals. The only adjustable parameter was the core radius. Author (NSA)

N71-16785# Arizona Univ., Tucson. Dept. of Chemistry.
LUMINESCENCE OF METAL COMPLEXES Final Report, 15 May 1968–30 Sep. 1970
Leslie S. Forster 30 Sep. 1970 13 p refs
(Contract AT(11-1)-773)
(COO-773-21) Avail: NTIS

The effects of structure and environment on the radiative and non-radiative transition probabilities in metal complexes are studied. The increasing technological importance of luminescent materials serves to focus attention on the possibility of varying the metal ion and the ligands over a wide range to provide a systematic

method of assessing the relevant factors. In many complexes the interaction between metal and ligands is so small that a perturbation approximation is useful. Within this approximation, electronic transitions are classified and used to analyze the depopulation of the 2E state in Cr(3+) systems. Author (NSA)

N71-16859*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF SURFACE PREPARATION ON OXIDATION OF WI-52 AT 1800 AND 2000 F (1255 AND 1366 K)
Carl E. Lowell and Isadore L. Drell Washington Feb. 1971 32 p refs
(NASA-TN-D-6148; E-5668) Avail: NTIS CSCL 11F

High-temperature X-ray diffraction, high-temperature microscopy, and weight-gain experiments were combined to investigate the effect of surface preparation on the static-air oxidation of WI-52, a cobalt-base superalloy. Surface preparation was found to affect the order, relative amounts, and morphology of the oxides formed. Oxidation at 1800 F for 100 hours caused weight gains in ground-and-lapped specimens that were four times that of metallographically polished specimens. Upon cooling, only the ground-and-lapped specimens spalled. Models of oxidation were developed to describe the surface-preparation effects. Author

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N71-15741# Royal Aircraft Establishment, Farnborough (England).
THE RELATIONSHIPS BETWEEN SNATCH-TEAR AND OTHER PROPERTIES FOR SETS OF UNCOATED AND COATED FABRICS
J. E. Swallow, E. Mikolajewski, and M. Webb Jun. 1970 31 p refs
(RAE-TR-70112) Copyright, Avail: NTIS

The snatch-tear behavior and bending parameters, breaking and tear strengths of 54 fabrics were studied. The fabrics were considered as sets of uncoated, coated, weave type, and rubber type materials, etc. The snatch-tear coefficient on energy input was negatively and often highly correlated with thickness, specific mass, bending length, flexural rigidity, breaking strength, and tear strength. Correlation with cover factor was high for uncoated fabrics of non-plain weaves. Author (ESRO)

N71-15742# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
A COMPRESSIVE TEST SPECIMEN FOR UNIDIRECTIONAL CARBON FIBRE REINFORCED PLASTICS
P. D. Ewins London Aeron. Res. Council 1970 24 p refs Supersedes RAE-TR-70007; ARC-32232
(ARC-CP-1132; RAE-TR-70007; ARC-32232) Copyright. Avail: NTIS; HMSO: 6s [30p]; BIS: $1.20

These test specimens enabled ultimate compressive strengths to be determined. Failure occurred remote from the specimen ends and tests showed good repeatability. Differences between theory and observations are discussed. Author (ESRO)

N71-15869# Douglas United Nuclear, Inc., Richland, Wash.
DEVELOPMENT OF A LONG-LIVED, HIGH-EXPANSION FOAM FOR ENTRAPPING AIR-BEARING NOBLE GAS
J. E. Mecca and J. D. Ludwick (Battelle Northwest) Aug. 1970 35 p refs Presented at the 11th AEC Air Cleaning Conf., Richland, Wash.
(Contract AT(45-D)-1857)
(DUN-SA-141; CONF-700816-3) Avail: NTIS

Development of a high expansion foam (300 to 1 expansion ratio) with the ability to withstand time (120 days or more) without the loss of internal structural integrity is described. The technique of blowing the foam with a flooded impingement plate, thus requiring no nozzles or devices prone to plugging, has proven reliable. Facilities and instrumentation are described and data from tests performed on a small bench top facility used to evaluate about 250 foam candidates are presented. The large facility used to successfully encapsulate quantities of 5,000 cubic feet of air-bearing, tagged noble gas at various ppM per cubic foot of air is also described. The foam techniques appear useful for controlling industrial gaseous emissions, dust suppression, gas scrubbing of reactor containment vessels, and in agriculture as an insulator for the prevention of frost damage. Author (NSA)

N71-15949# Technische Hochschule Hannover (West Germany).
ON LONG-TERM OSCILLATION BEHAVIOR OF GLASS FIBER REINFORCED SYNTHETIC MATERIALS [ZUM DAUERSCHWINGVERHALTEN GLASFASER-VERSTAERKTER KUNSTSTOFFEE]
Kurt Wagener (Ph.D. Thesis) 1970 150 p refs In GERMAN
Avail: NTIS

Oscillation measurements on glass fiber reinforced synthetics developed their stability dependency on glass content, sample geometry, stress factors and control conditions. It was shown that exact long term stability values could not be obtained because Woehler curves of all investigated resin-glass combinations leaned markedly towards time- or load-axis abscissa. Epoxy resins performed superior to polyester and polybutadiene based resins in each combination and load test performed; however, increased temperatures lowered resin lifetimes for all investigated resins. Transl. by G.G.

N71-15988# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF THE THERMAL EXPANSION OF REFRACTORY OXIDES AT HIGH TEMPERATURES
D. M. Shakhtin et al 29 Jul. 1970 21 p refs Transl. into ENGLISH from Sb. Nauchn. Tr., Vkr. Nauchn.-Issled. Inst. Ogneuporov (Kharkov), v. 57, no. 11, 1967 p 160-171
(AD-714741; FTD-HT-23-343-70) Avail: NTIS CSLC 11/2

The coefficient of thermal expansion from 1997 to 2297 degrees centigrade was determined experimentally for aluminum and magnesium oxides and Al2O3 solid solution in MgAl2O4. The nature and characteristics of thermal expansion were established for a series of ZrO2 samples stabilized by varied amounts of MgO, CaO, or Y2O3 and with monoclinic ZrO2 additions in varied amounts. Author (GRA)

N71-16020# Harry Diamond Labs., Washington, D.C.
SHOCK WAVE STRUCTURE IN BaTiO3 CERAMIC
Philip S. Brody and Michael J. Vrabel Aug. 1970 18 p refs
(AD-714673; HDL-TM-69-41) Avail: NTIS CSCL 20/11

The elastic-plastic shock wave profile in BaTiO3 4 wt percent PbTiO3 has been determined for an 80-kbar shock using quartz gauges. The results indicate that the elastic wave rises abruptly compared with the plastic wave. The rise time of the 80-kbar plastic wave is at least 500 nsec. The thickness of the front is about 2mm. The rise time of the elastic pulse is 20 nsec or less. The thickness is 0.12 mm or less. Author (GRA)

N71-16046* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
BACTERIOSTATIC CONFORMAL COATING AND METHODS OF APPLICATION Patent
Francis N. Le Doux and Charles Bland, inventors (to NASA) Issued 6 Oct. 1970 (Filed 30 Mar. 1967) 4 p Cl. 117-201; Int. Cl. H05k3/28
(NASA-Case-GSC-10007; US-Patent-3,532,538; US-Patent-Appl-SN-627599) Avail: US Patent Office CSCL 06Q

A method for making bacteriostatic electronic components is discussed. Application of a thin coating of a curable epoxy resin to electronic components provides protection against reproduction and growth of vegetative and sporulative bacteria and also restrains the components at high vibrational levels. NASA

N71-16060# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PHYSICAL AND MECHANICAL PROPERTIES OF FIBER-GLASS REINFORCED PLASTICS: A COLLECTION OF ARTICLES
Yu. M. Molchanova 19 Aug. 1970 328 p refs Transl. into ENGLISH of the publ 'Fizicheskiye i Mekhanicheskiye Svoetva Steklioplastikov' Riga, Izd-Vo. Zinatne, 1969 p 1-267
(AD-714724; FTD-MT-24-96-70) Avail: NTIS CSCL 11/4

The report on the physicomechanical properties of Soviet fiber-glass reinforced plastics is a manual, compiled from the available source material, state standards, and also the technical conditions for the most important fiber-glass reinforced plastics. In the first section a description of the mechanical, physical and electrical methods of testing fiber-glass reinforced plastics is given, the bases of which are the state standards. In cases, when the tests have not been standardized in the Soviet Union, methods are used, which have been described in literature. The second section contains data about domestic fiber-glass reinforced plastics (silicon organic, polyester, phenolic, epoxy and others), and also the firm names of foreign fiber-glass reinforced plastics and their basic properties. In collecting these data mainly periodical publications on the technology, processing and application of polymeric materials were used. Author (GRA)

N71-16105* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD OF MAKING SELF-LUBRICATING FLUORIDE-METAL COMPOSITE MATERIALS Patent
Harold E. Sliney, inventor (to NASA) Issued 28 Apr. 1970 (Filed 11 Mar. 1968) 5 p Cl. 117-119; Int. Cl. B44d1/02 Continuation-in-part of US Patent Appl. SN-635972, filed 1 May 1967
(NASA-Case-XLE-08511-2; US-Patent-3,508,955; US-Patent-Appl-SN-711921) Avail: US Patent Office CSCL 11H

A self-lubricating composite material for use in a chemically reactive environment is obtained by impregnating a porous metal with a barium fluoride-calcium fluoride eutectic composition. This bearing or sealing material will function as a lubricant and be chemically stable at high temperatures above 1000 F in air, hydrogen, and liquid alkali metals. Official Gazette of the U.S. Patent Office

N71-16121# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PREPARATION OF THE CHROMIUM CARBIDES Cr7C3 AND Cr23C6
M. Kh. Freid et al 12 Aug. 1970 10 p refs Transl. into ENGLISH from Izv. Vysshykh Uchebn. Zavedenii, Khim. i Khim. Tekhnol. (Ivanovo), v. 12, no. 2, 1969 p 224-227
(AD-713879; FTD-HT-23-403-70) Avail: NTIS CSCL 7/2

The study of preparation techniques of given chromium carbides was needed to obtain single phase carbides for determination of electrochemical and corrosion characteristics. Intercrystalline corrosion in Ni-Cr steel was correlated with the presence of these chromium carbides. The effect of temperature in the 1100-1500 degree centigrade range was studied on the composition of given products. At a temperature lower than the optimum the product contained given chromium carbides; at a higher temperature, it contained given chromium carbides impurity. The single phase nearly stoichiometric chromium carbides given was prepared by on heating at 1400 degrees centigrade a briquetted charge of electrolytic chromium and lamp black in a hydrogen stream for 15 min. Two given mixtures were produced at a temperature below or above 1400 degrees centigrade respectively. Author (GRA)

N71-16122# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SYNTHESIS AND STUDY OF THE ANTIWEAR ADDITIVE INKhP-46
A. M. Kuliev et al 11 Aug. 1970 9 p Transl. into ENGLISH from Azerb. Neft. Khoz (Baku), v. 48, no. 6, 1969 p 33-34
(AD-713880; FTD-HT-23-384-70) Avail: NTIS CSCL 7/3

Phenol alkylated with polymer distillate was heated with anhydrous chloral in naphtha solution at 80 degrees 2.5 hrs., and the product heated with phosphorus pentasulfide 1.5 hrs. at 100 degrees and 5-6 hrs. at 120 degrees, dissolved in naphtha, and filtered to remove excess phosphorus pentasulfide. Removal of the solvent in vacuo gave the additive. Solution (3 percent) in various oils have antifriction and antiwear properties superior to those of comparitive additives. Author (GRA)

N71-16123# Naval Ordnance Lab., White Oak, Md.
SYNTHESIS OF CO-IMIDE-QUINOXALINES
J. M. Augl 20 Jul. 1970 19 p refs
(AD-713886; NOLTR-70-114) Avail: NTIS CSCL 7/3

Phenylated, ordered imide-quinoxaline copolymers of high oxidative-thermal stability were prepared by one-step solution condensation of aromatic tetraamines with N,N-bis(4-benzilyl) pyromellitimide. Polymerization in m-cresol leads to high molecular weight polymers that remain soluble. Thermal gravimetric analysis and isothermal decomposition at 400C shows that these polymers are as stable as polyimides or polyquinoxalines. The polymer decomposition temperatures range between 495 and 550C, depending upon structure. Also, the rate of isothermal decomposition at 400C in air showed a strong dependency of weight loss on structure. Tough films were cast from solution. Author (GRA)

N71-16124* IIT Research Inst., Chicago, Ill.
LIGHTWEIGHT REFRACTORY INSULATION AND METHOD OF PREPARING THE SAME Patent
Hiroshi H. Nakamura, Harold L. Rechter, and Adi J. Mountvale, inventors (to NASA) Issued 28 Apr. 1970 (Filed 17 Feb. 1967) 6 p Cl. 106-88; Int. Cl. C04b21/10, 21/00 Sponsored by NASA
(NASA-Case-XMF-05279; US-Patent-3,508,940; US-Patent-Appl-SN-617774) Avail: US Patent Office CSCL 13A

A lightweight refractory insulation composition for use as a rigid heat shield. The composition comprises, in weight percent, zircon, mullite or calcium aluminate, 54 to 75; an alkali metal silicate binder, 6.9 to 8.5; a complexing agent, 1 to 3; refractory fibers, 1.5 to 10; water, 23.9 to 25.7; whipping agent, 0.15 to 1.0 and clay, 0 to 2. This composition is prepared and fabricated by mixing the above ingredients, whipping the mixture to produce a castable foam, applying the foam as a layer on the substrate to be protected and curing by heating to a temperature less than about 260 F. The resulting heat shield exhibits favorable heat reflecting properties and mechanical integrity sufficient to withstand severe vibration and acceleration forces. Official Gazette of the U.S. Patent Office

N71-16125# Lockheed Missiles and Space Co., Palo Alto, Calif.
POLYMORPHISM OF OXIDES OF RARE-EARTH ELEMENTS
S. M. Braun [1970] 4 p refs Transl. into ENGLISH from Poroshkovaya Met., Akad. Nauk SSR (Kiev), no. 6(90), 1970 p 82–85
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Polymorphic transformations of the sesquioxides of the lanthanoids are of interest for a study of the nature of polymorphism since the corresponding polymorphic forms of the different oxides are completely isomorphic to each other, and their lattice parameters vary in proportion to the cation radii in a number of these oxides. Oxides of the lanthanoids are quite stable, they melt above 2000 deg and do not dissociate prior to the melting point: samarium, europium, and ytterbium oxides are the exception, which go over into oxides richer in oxygen in a reducing medium or in a deep vacuum at high temperatures. Data on the melting points of the lanthanoid oxides are presented. As the order number of the lanthanoids increases, the melting points of their sesquioxides rise. The deviation from the general regularity is observed for cerium, praesodymium, europium, and ytterbium oxides. Author

N71-16207# Army Foreign Science and Technology Center, Washington, D.C.
METHODS OF PRODUCING FIBERS WITH SPECIAL PROPERTIES [METODY POLUCHENIYA VOLOKON SO SPETSIALNYMI SVOISTVAMI]
L. A. Volf et al 23 Sep. 1970 11 p refs Transl. into ENGLISH from Khim. Volokna (Leningrad), v. 11, no. 1, 1969 p 13–16
(AD-714121; FSTC-HT-23-272-70) Avail: NTIS CSCL 11/5

The problems of imparting special properties to various types of fibers especially those of polyvinyl acetate, the materials and methods used for this purpose are briefly discussed. Of particular interest are: semiconductor, ion exchange, electron exchange, biologically active, and other fibers with special properties. Author (GRA)

N71-16208# Army Foreign Science and Technology Center, Washington, D.C.
MICROBIOLOGICAL CORROSION OF PLASTIC PETROLEUM BASED LUBRICANTS [MIKROBIOLOGICHESKAYA KORROZIYA PLASTICHNYKH SMAZOK, IZGOTOVLENNYKH NA NEFTYANOI OSNOVE]
S. N. Litvinenko et al 1 Sep. 1970 7 p Transl. into ENGLISH from Neft. i Gaz. Prom., Nauchn.-Tekhn. Sb. (Kiev), no. 6, 1969 p 34–35
(AD-714133; FSTC-HT-23-869-70) Avail: NTIS CSCL 11/8

The report contains the results of a study of the stability of various plastic lubricants and their components against damage by microorganisms. Author (GRA)

N71-16209# Army Foreign Science and Technology Center, Washington, D.C.
PHYSICAL AND MECHANICAL PROPERTIES OF GLASS REINFORCED PLASTICS
Yu. M. Molchanov 2 Jun. 1970 285 p refs Transl. into ENGLISH from the Russian
(AD-714508; FSTC-HT-23-660-70) Avail: NTIS CSCL 11/4

The physical and mechanical properties of domestially-produced glass-reinforced plastics are presented, based on available data including state standards and technical conditions for the most important types. Mechanical, physical and electrical testing methods are described. Detailed data are presented for domestic silicon, organic, polyester, phenol and epoxy plastics and the properties of principal-foreign-produced plastics are included as well. GRA

N71-16210* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FLEXIBLE COMPOSITE MEMBRANE Patent
Stephen P. Vango and Lois L. Taylor, inventors (to NASA) Issued 1 Sep. 1970 (Filed 19 Dec. 1967) 5 p Cl. 204-20; Int. Cl. C23b5/60 Sponsored by NASA
(NASA-Case-XNP-08837; US-Patent-2,526,580; US-Patent-Appl-SN-691736) Avail: NTIS CSCL 13D

A chemically stable, completely fluid impervious flexible membrane is fabricated on a base layer having essentially the chemical and physical characteristics of polymerized tetrafluoroethylene by bonding to a surface of that base a flexible metallic layer, typically of lead. Pores in the metal layer are sealed by application and fusion of indium. The composite membranes of the structure are particularly useful as expulsion membranes for rocket propellants, since they are impervious to, and chemically compatible with, even such highly reactive oxidizers as nitrogen tetroxide. Official Gazette of the U.S. Patent Office

N71-16322# Picatinny Arsenal, Dover, N.J.
THE EFFECTS OF di-t-BUTYLPEROXIDE ON THE OXIDATIVE STABILITY OF POLYPROPYLENE, 2
J. Rubin and E. Schramm Oct. 1970 34 p refs
(AD-714369; PA-TR-4088) Avail: NTIS CSCL 11/9

The oxidative embrittlement of polypropylene film (5 mil) has been studied by measuring stress-strain behavior, molecular weight changes, and development of carbonyl concentration in the infrared spectrum. Oxidation was conducted both in air and in peroxide in the temperature range of 50-90C. The mechanical measurements show the effects of oxidation in the most responsive way; the embrittlement can be clearly seen as a sudden decrease in the elongation at break. The use of infrared carbonyl concentration to follow degradation effects has been found to be ineffective. It is only when the oxidation has proceeded to an advanced stage that the carbonyl concentration begins to show itself at a significant level. The cause of the drastic change in mechanical properties is believed to be the scission of tie molecules in the amorphous phase which interconnects crystalline regions. Author (GRA)

N71-16344# Catholic Univ. of America, Washington, D.C.
A GENERAL NUMERICAL LARGE DEFLECTION SOLUTION OF THE COAXIAL RING CIRCULAR GLASS PLATE FLEXURE PROBLEM
Robert Kao, Webster Capps (NBS), and Nicholas Perrone Oct. 1970 33 p refs
(Contracts N00014-68-A-0506-0002; N00014-67-A-0377-0011)
(AD-714154) Avail: NTIS CSCL 11/2

A stress analysis is presented which accurately describes stresses and deflection profiles in thin sheets of high strength glass bent multi-axially with central deflections up to three times the thickness of the plate. Favorable comparisons are made between the predicted deflection profiles and those realized experimentally. Author (GRA)

N71-16362# Johns-Manville Research Center, Manville, N.J.
PHYSICAL PROPERTIES OF SONITE Final Report, 12 Sep., 1969–30 Apr. 1970
Arnold E. Jabin 27 Apr. 1970 121 p refs
(Contract N66001-70-C-0309)
(AD-714229; Rept-3901-26) Avail: NTIS CSCL 11/4

Sonite, a highly porous, particulate, fiber-reinforced, ceramic material used in acoustics, was studied to: acquaint potential users with methods of handling and fabrication; determine useful mechanical, electrical and acoustic properties. Sonite is a solid material which is capable of being handled and fabricated into intricate shapes and parts, with a modest amount of care, using conventional techniques. Tested under various load conditions, the

product, after being prestressed, exhibited basically elastic mechanical-acoustical properties, up to the prestress limit. The velocity of sound propagation and the acoustic impedance were both linear and of very low magnitude when compared with water. The above mentioned properties were not affected by variations in temperature lower than ambient (4-30C). Sonite also showed a low modulus of elasticity and a low mechanical damping capacity for a ceramic material of high porosity. Author (GRA)

N71-16370# Bendix Corp., Kansas City, Mo.
THIRD-DIRECTION REINFORCEMENT OF CARBONIZED COMPOSITES
H. F. Darbyshire Aug. 1970 59 p
(Contract AT(29-1)-613)
(BDX-613-144) Avail: NTIS

The purpose was to obtain high tensile strengths and ablation properties of carbonized composites. The work was divided into three categories: (1) three-dimensional weaving (interweaving of fibrous members from each layer of woven filaments into the members of adjacent layers); (2) stake-reinforcement (interlaminar reinforcement of cross-ply carbon roving laminated composites by inserting carbon fiber stakes through the stacked layers before press curing and carbonization); and (3) short-fiber moldings (molding of short lengths of randomly oriented carbon fibers in a resin binder mix to produce uniform density and equal directional strengths). Author

N71-16371# Sandia Corp., Albuquerque, N.Mex.
CONCERNING THE HIGH-TEMPERATURE THERMAL CONDUCTIVITY OF CARBON FOAMS
J. A. Corll Sep. 1970 53 p refs Sponsored by AEC
(SC-RR-70-622) Avail: NTIS

A calculation model for a low density foam insulator based on a rectangular array of super sphere shaped pores is developed. The model is expanded to include the effects of radiation shine through of very thin pore walls and applied to amorphous carbon foams. Numerical results of the calculations are reported for foam densities between 0.05 gm/cc and 0.25 gm/cc for temperatures between 1000 K and 3500 K. The results are compared with experimental data for a low density blown carbon foam. The comparison is good. The implications of the model are discussed in connection with optimization of thermal insulation foams for shielding short duration heat pulses. Author

N71-16372# Bendix Corp., Kansas City, Mo.
NEW TECHNIQUE FOR DETERMINING IN HETEROGENEOUS MEDIA: PLASTIC FOAM
D. W. Liou and W. M. Lee Sep. 1970 31 p refs Sponsored by AEC Prepared by Dow Chem. Co., Midland, Mich. for Bendix Corp., Kansas City, Mo.
(BDX-613-229) Avail: NTIS

A theoretical technique to predict the pressure and concentration profiles of a gas in a heterogeneous structure was developed. The technique considers the heterogeneous foam structure as a three-dimensional array of cubical cells of the same size. Systems of differential equations were solved for one and two dimensional cases to simulate the phenomena of mass diffusion in-and-out of a closed multicellular structure. The mass diffusion phenomenon in plastic foam is investigated by defining a foam diffusivity for the gas of interest treating the foam as, on a macro-scale, a homogeneous material. The determination of this foam diffusivity, based on heterogeneous structure calculations, is discussed. Author

N71-16394# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
INVESTIGATION OF NONMETALLIC WATERSTOPS. REPORT 7: PREPARATION OF LABORATORY TEST SAMPLES FROM FINISHED WATERSTOPS
Billy J. Houston Aug. 1970 31 p
(AD-714219; AEWES-TR-6-548-7) Avail: NTIS CSCL 11/1

Corps of Engineers Specifications for rubber and polyvinylchloride (PVC) waterstops require that the manufacturer furnish sheet material from the same lot as the finished waterstop for acceptance testing. Since the sheet samples have been found in some cases to have properties different from the finished waterstop, a study was made to determine the feasibility of preparing all test samples in the laboratory from the finished waterstop. Two natural rubber and two PVC specimens were tested. A molding study was also conducted to determine the optimum temperature-time-pressure combination for preparing test samples. Test results confirmed that sheet samples submitted by the manufacturer were not always representative of the finished waterstop and indicated that laboratory-prepared specimens were more representative. The type of equipment to be used in molding, slicing, and grinding the waterstop is described in the report. Author (GRA)

N71-16396# Honeywell, Inc., Hopkins, Minn. Corporate Research Center.
AN ASSESSMENT OF SURFACE AND SUB-SURFACE DAMAGE INTRODUCED IN CERAMICS BY SEMI-FINISH GRINDING OPERATIONS
B. G. Koepke Oct. 1970 53 p refs
(Contract N00014-69-C-0123)
(AD-714491; TR-2) Avail: NTIS CSCL 11/2

The nature and extent of grinding damage introduced by surface grinding a number of ceramics having widely varying mechanical properties was studied. Surface damage was characterized by optical and electron microscopy and subsurface damage was observed using etch pit techniques. Grinding damage was found to depend strongly on wheel type and rate of material removal as well as on the mechanical behavior and microstructure of the workpiece. The results indicate that grinding damage is mainly composed of mixtures of three types depending on the mechanism of material removal. When material is removed efficiently from low impact resistance ceramics (e.g., magnesium oxide and ferrite) the surfaces are generated by brittle fracture and are composed of regions of transgranular and intergranular fracture. When grinding is inefficient; i.e., when the grinding wheel loads up, material is removed by plastic flow. The resultant surfaces on deformable ceramics (e.g., magnesium oxide, ferrite, and silicon) are smooth and burnished but may contain thermal cracks due to the heat generated. In this instance subsurface damage consists of a discrete, highly deformed layer containing cracks in most cases. Author (GRA)

N71-16434# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF THE PROCESS OF THE FORMATION OF NIOBIUM CARBIDE ON GRAPHITE PARTICLES
P. G. Tsybe et al 27 Aug. 1970 12 p refs Transl. into ENGLISH from Russian report
(AD-714416; FTD-HT-23-529-70) Avail: NTIS CSCL 13/8

The procedure and equipment were worked out for gas vapor phase deposition of refractory metal carbides and nitrides onto graphite particles in a fluid bed. Details were worked out specifically for the deposition of niobium carbide. Curves showing deposit thickness as function of process time and temperature indicate a diffusion process. X-ray structural analyses established that a uniform deposit of niobium carbide, of nearly stoichiometric composition, was formed about the entire particle surfaces. Author (GRA)

N71-16438# Watervliet Arsenal, N.Y.
PROCEEDINGS OF THE INTERSERVICE TECHNICAL

MEETING ON GUN TUBE EROSION AND CONTROL
I. Ahmad and J. P. Picard, eds. Jun. 1970 551 p refs Conf. held at Watervliet, N.Y., 25–26 Feb. 1970
(AD-714668) Avail: NTIS HC $10.00/MF $0.65 CSCL 19/6

The principal aspects of erosion which were considered during the course of this meeting were description of eroded bores, influence of erosion on the accuracy and life of gun tubes, erosion vs fatigue in various cannon tubes, erosiveness of propellants, physical chemistry of erosion, metallurgical aspects of erosion, thermal checking - its nature and effects, techniques of studying gun erosion, effect of rotating bands on the tube erosion, erosion resistant coatings, new concepts in material applications to gun tubes, new concepts in propellants, and new concepts in tube design. Author (GRA)

N71-16448# Bendix Corp., Kansas City, Mo. Aerospace Electronics.
MEDIUM DENSITY MOLDED FOAM
J. F. Fender Aug. 1970 26 p
(Contract AT(29-1)-613)
(BDX-613-209) Avail: NTIS

A foam system was developed for the production of high-strength, medium-density, molded-to-size foam products with high yield. Processes were optimized for the production of medium-density foam with the necessary dimensional stability, strength, and moldability. Studies of mold releases and their effects on bonding operations show that mechanical abrasion of surfaces before bonding provides good adhesion, use of a solvent on the surface does not improve adhesion, a semi-permanent mold release provides the best bonding where abrasion is not practical. Other studies show that catalysts did not have pronounced effects on either localized shrink areas or compressive strengths. Author

N71-16466# Grumman Aerospace Corp., Bethpage, N.Y. Materials and Structural Mechanics Section.
FINITE-ELEMENT ANALYSIS OF INTERLAMINAR SHEAR IN FIBROUS COMPOSITES
G. Isakson and A. Levy Jan. 1971 21 p refs
(RM-492) Avail: NTIS

The effect of elastic interlaminar shear deformation on the stresses in laminated fibrous composites is analyzed by means of a finite-element method of the displacement type. The model of the laminate consists of two-dimensional orthotropic membranes separated by isotropic shear layers of finite thickness. Triangular uniform-strain elements are used in the idealization. Application is made to a rectangular panel of + or − 45 deg angle-ply construction loaded in tension along two opposite edges. Results for the edge effect associated with interlaminar shear are found to agree closely with corresponding results from a closed-form analytical solution. Author

N71-16481# Westinghouse Electric Corp., Baltimore, Md. Systems Development Div.
THE 3200 ANGSTROM PHOSPHOR Progress Report, 1 Jan.–30 Jun. 1970
Jon W. Ogland, Edward C. Malarkey, and Michael R. Natale Oct. 1970 48 p refs
(Contract DAAB07-68-C-0392)
(AD-714301; ECOM-0392-7; PR-7) Avail: NTIS CSCL 11/7

The objective of the contract is to conduct a research and development program leading to the production of a cathodoluminescent phosphor which emits whith high efficiency in the spectral region around 3200 A. This phosphor is to be incorporated into very high resolution cathode-ray tubes with fiber optic faceplates for data recording on UV sensitive, dry-process films. The efficiencies and maintenance values of all promising phosphor materials have been determined. Several samples of the barium zinc silicate series showed the highest CL efficiency yet reported for the 3200 A wavelength region. $Sr_2ZnSi_2O_7$:Pb has been chosen as the final phosphor for the 3200 A tubes by virtue of its efficiency, insensitivity to loading, and resistance to degradation. Other compositions of the X-series were also found to be quite durable, but slightly less efficient. Further progress was realized in reducing the particle size of the 3800 A phosphor, Zn_2SiO_4:TiO_2. GRA

N71-16486# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Materials Lab.
THERMAL ANALYSIS OF ABLATIVE PLASTIC MATERIALS. PART 1: CONSTANT HEATING RATE THERMOGRAVIMETRY OF CARBON/GRAPHITE CLOTH REINFORCED AROMATIC/HETEROCYCLIC RESINS TO 1400 C Technical Report, Mar. 1968–Dec. 1969
R. W. Farmer Aug. 1970 184 p refs
(AD-714084; AFML-TR-70-35-Pt-1) Avail: NTIS CSCL 11/4

Applications for polyaromatic and polyheterocyclic resins and their reinforced composites include ablative thermal protection, coatings, radomes, and structures. The response of these materials in high temperature service environments was predicted by kinetics. Kinetic parameters n, A, and E were evaluated for eight carbon and graphite cloth ablative composites. An integral method computer code and a maximum rate of weight method computer code were used for this purpose. A -325 sieve, dried 80 mg powder was run at 8.5C/min to 1400C in a helium purge of 1 liter/min. The relative order of resin thermal stability was polybenzimidazole > polyphenylene > polyimide > phenylphenol formaldehyde and phenol formaldehyde. Thermograms were plotted with a third computer code to compare with the experimental one. Graphite cloth composites gave the best overall agreement. Typical residual weight difference at constant temperature ranged from 0.8% for phenol formaldehyde/graphite cloth up to 2.3% for polyimide/carbon cloth. Author (GRA)

N71-16495*# Techtran Corp., Glen Burnie, Md.
STRAIN-ENERGY THEORY OF FAILURE OF ORIENTED FIBER GLASS-REINFORCED PLASTIC LAMINATES UNDER BIAXIAL COMPRESSION [ENERGETICHNA TEORIYA RUINUVANNYA ORIENTOVANIKH SHARUVATIKH SKLOPLASTIKIV PRI DVOVISNOMU STISKU]
V. P. Yatsenk et al Washington NASA Jan. 1971 6 p refs Transl. into ENGLISH from Dopovid. Akad. Nauk Ukr. SSR (Kiev), ser. A, v. 30, Oct. 1968 p 941–943
(Contract NASw-2037)
(NASA-TT-F-13444) Avail: NTIS CSCL 11D

Fiber glass reinforced plastics were produced using the longitudinal transverse winding method. Strain energy in anisotropic free axis is also discussed. J.A.M.

N71-16499*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EVALUATION OF LINEAR POLYETHYLENE AND FIBER GLASS REINFORCED EPOXY FOR USE AS IRRADIATION CAPSULES
Richard J. Mittendorf Feb. 1971 24 p refs
(NASA-TM-X-52957) Avail: NTIS CSCL 11D

Sealed plastic capsules have been irradiated in unsealed metal rabbits (irradiation containers). The purpose was to determine the operating limits for the irradiation of experiments in these capsules. Both linear polythylene and fiberglass reinforced epoxy capsules were tested. The operating limits for the irradiation of experiments in polyethylene capsules have been defined. The epoxy capsules became highly radioactive when irradiated and failed at lower levels of exposure than the polyethylene capsules. Author

N71-16500*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPLICATION OF SERT 2 THERMAL CONTROL COATINGS
N. John Stevens Washington Feb. 1971 34 p refs
(NASA-TM-X-2155; E-5859) Avail: NTIS CSCL 11C

The application techniques developed for applying thermal control coatings to the SERT II spacecraft are described. The coatings are white inorganic paint (Z-93), aluminum foil tape, and polished aluminum. Solutions to the problems encountered are presented. The test program used to determine the mechanical and optical properties of the coatings is discussed. Author

N71-16503*# Techtran Corp., Glen Burnie, Md.
DETERMINATION OF THE THEORETICAL COMPRESSION STRENGTH OF REINFORCED MATERIALS [PRO VIZNACHENNIA TEORETICHNOI GRANITSI MITSNOSTI NA STISK ARMOVANIKH MATERIALIV]
O. M. Guz Washington NASA Jan. 1971 7 p refs Transl. into ENGLISH from Dopovidi Akad. Nauk Ukr. SSR (Kiev), ser. A, v. 31, Mar. 1969 p 236–238
(Contract NASw-2037)
(NASA-TT-F-13443) Avail: NTIS CSCL 11D

Theoretical limits of the compression strength of reinforced materials are investigated. Stress components, which are greater than the others, act along the fibers in fibrous materials and along the layers in layered materials. Destruction of the material occurs along planes perpendicular to the direction of the stress forces. Author

N71-16517# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.
STANDARD REFERENCE MATERIALS: VISCOSITY OF A STANDARD BOROSILICATE GLASS
A. Napolitano and E. G. Hawkins Dec. 1970 12 p refs
(NBS-SP-260-23) Avail: SOD $0.25

Methods for determining the viscosity of borosilicate glass are presented. Measurements were made by the rotating cylinder, fiber elongation, beam bending, and parallel-plate methods. The results have been evaluated and the glass has been issued as Standard Reference material Number 717. Author

N71-16595*# Lockheed-Georgia Co., Marietta.
DEVELOPMENT, FABRICATION, TESTING, AND DELIVERY OF ADVANCED FILAMENTARY COMPOSITE NONDESTRUCTIVE TEST STANDARDS Final Report
W. M. Pless, B. L. Weil, and W. H. Lewis Nov. 1970 110 p refs
(Contract NAS8-25679)
(NASA-CR-103011; ER-10883) Avail: NTIS CSCL 11D

Detailed designs of the test standards, including configuration, placement of defects/variations, and fabrication methods are presented together with the NDT development and results. Destructive tests were conducted on additional test panels, where necessary to verify the defective condition of the standards. A single nondestructive test method did not reveal all possible defects in a composite structure. Two or more methods were used in a complementary fashion to characterize these materials adequately. Generally, radiography and ultrasonic C-scan techniques reveal most defects that may be present in a single structure. Author

N71-16596*# Midwest Research Inst., Kansas City, Mo.
A FEASIBILITY STUDY OF THE USE OF GRAPHITE IN HIGH VACUUM APPLICATIONS Summary Technical Report, 2 Jun. – 2 Dec. 1970
George A. Beitel 10 Dec. 1970 49 p refs
(Contract NAS1-10067)
(NASA-CR-111829) Avail: NTIS CSCL 11D

The state of the art of graphite technology as it relates to high vacuum technology is reviewed. A literature search was conducted to establish the extent to which the vacuum properties of graphite are known and to identify prior, successful applications in high vacuum. Experimental tests were performed to determine the outgassing characteristics and to measure the sticking probabilities for H2 and CO on high density, highly oriented pyrolytic graphite, POCO graphite, and Grafoil tape. Most available properties of graphite have been collected and are presented in table form. Experiments show that the outgassing load of graphite after having been baked at 300 C for 24 hr, is comparable on a weight basis to that of tungsten. The sticking probability for CO was found to be approximately 0.00005 and decreases rapidly for coverages approaching 0.01 monolayer. An upper limit for the sticking probability for H2 was set at 10 to the minus 8th power. Author

N71-16600*# Colspan, Inc., Boulder, Colo.
EXTERNAL INSULATION SYSTEMS FOR CRYOGENIC STORAGE SYSTEMS Interim Study Report
Thomas M. Flynn, Jerry B. Kirgis, and John R. Wilson 2 Nov. 1970 109 p refs
(Contract NAS9-10583)
(NASA-CR-114827) Avail: NTIS CSCL 11D

Investigated were high performance external insulation systems for use on flight weight cryogenic gas storage systems. The fluids stored are hydrogen and oxygen. Preliminary thermal analysis, support analysis, producibility, operability and other factors were considered for five systems. Three systems, a shingle with substrate, fiberglass and blanket, were chosen for detailed analysis. Development work on mathematical models for the analyses is nearly completed, and summaries of the mathematical models and programming are presented. Author

N71-16694# Interand Corp., Rockville, Md.
A NEW COMPOSITE CERAMIC PIEZOELECTRIC TRANSDUCER MATERIAL
William W. Lester 1 Nov. 1970 13 p refs
(Contract N00014-70-C-0182)
(AD-714494; IW69-20-TM-1U) Avail: NTIS CSCL 9/1

A new whisker reinforced piezoelectric ceramic was made which exhibits good properties as a transducer material. The most successful material to date is a lead zirconate titanate composite with a sapphire whisker additive, prepared by a cold press and sinter technique. Measurement of the dielectric permittivity, dielectric loss tangent, electromechanical coupling factor, and mechanical Q are reported for some of these first available samples. Indications are that whisker containing samples undergo different aging processes than nonwhisker containing samples, as indicated by the activation energy for domain wall motion. Measurements of the pyroelectric effect indicate that the whisker containing samples are under large compressive stresses at room temperature. Some comments on possible advantageous properties of this new material are presented. Author (GRA)

N71-16695# Oklahoma State Univ., Stillwater.
DEVELOPMENT OF SUPERCONDUCTING POLYMERS Interim Technical Report, Dec. 1968 – Jun. 1970
Herbert A. Pohl Jun. 1970 191 p refs
(Contract DAAK02-69-C-0164)
(AD-714879; OSU-RF-70-R-1) Avail: NTIS CSCL 20/3

The report presents results of a search for polymeric materials which theoretically could function as superconductors at elevated temperatures. Among the several thousand polymeric materials which one can expect to be electronically conductive, the authors

have to date, examined some 95 for evidence of superconduction. Of those, none were superconducting, but several were found which were very highly conductive, exceeding graphite and packed copper powder in conductivity, and increasing in conductivity as the temperature was lowered. Many others which were quite conductive were found. Many materials were found which displayed a new and very intense dielectric polarization (hyper-electronic polarization). Dielectric constants up to 300,000 are being shown by these organic solid materials. New synthetic procedures for conducting polymers were uncovered. Unique equipment capable of detecting superconduction magnetically and conductively at cryogenic temperatures and at extreme pressure was developed here and is now in use. Author (GRA)

N71-16697# Los Alamos Scientific Lab., N.Mex.
CERAMIC COATINGS USED IN CASTING PLUTONIUM AND ITS ALLOYS
D. R. Harbur, B. N. Robbins, and J. W. Romero Sep. 1970 3 p ref
(Contract W-7405-eng-36)
(LA-4495) Avail: NTIS

Many ceramic materials are inert to molten plutonium, but fragility and porosity of ceramic crucibles make them impractical for use in the plutonium foundry. Oxidized tantalum crucibles are inert to pure plutonium and to some of the low-melting-point alloys of plutonium. To take advantage of the ruggedness of metal crucibles, ceramic coatings inert to plutonium alloys at high temperatures that can be applied to metal or graphite crucibles and molds were developed. Descriptions of these coatings and the processes by which they are applied are given. Author (NSA)

N71-16728# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
FABRIC FLAMMABILITY TEST DEVELOPMENT
W. R. Brown and F. A. Vassallo May 1970 88 p refs
(Contract NBS CST-982-5)
(PB-194614; CAL-VH-2856-Z-1; NBS-GRC-2) Avail: NTIS CSCL 11E

Heat meter instrumentation and a test chamber were developed for the measurement of heat transfer from burning and smoldering fabrics. The meters yield a signal proportional to heat flux, and a four-channel electronic integrator provides total heat input data as a function of time. Literature data on skin damage vs. heat input are employed in a graphical overlay method of interpreting data in terms of skin damage. Data demonstrating good reproducibility in tests of cotton fabrics at various spacings are presented. Thermoplastic fabrics tended not to burn or smolder regularly in the flat panel form employed in the test, but recommendations are given for study of strip specimens which may be amenable to test by the suggested methods. It was found that all of the fabric specimens which burned regularly in the chamber produced heat inputs at least double those required to inflict second-degree burns. Author (USGRDR)

N71-16729# Mississippi Univ., University. Dept. of Chemistry.
INVESTIGATION OF GAMMA-RAY INDUCED POLYMER FORMATION OF THE CARBORANES Annual Progress Report
Theodore J. Klingen 1 Nov. 1970 46 p refs
(Contract AT(40-1)-3781)
(ORO-3781-7) Avail: NTIS

Research on the gamma-radioinduced polymerization of substituted o-carboranes (indexed as 1,2-dicarbadodecaborane) was continued. The radioinduced polymerization of 1-vinyl-o-carborane led to one product, a polymer that has been characterized in previous studies. An unsuccessful attempt was made to determine the melting point of the polymer. An increase in temperature was found to result in an increase in number average molecular weight of the polymer. Mass spectral analysis of yields of the radiolysis of 1-isopropenyl-o-carborane indicates that polymerization does not proceed much beyond the dimer stage. Dimer products were characterized. Attempts were made to characterize the structure of 1-ethyl-o-carborane. Studies indicate that radiolysis does not cause significant interconversion of the ortho, meta, and para isomers of the carboranes. NSA

N71-16730*# Singer General Precision, Inc., Little Falls, N.J. Kearfott Div.
BIS(EPOXY ALKYL) CARBORANE ADHESIVES Final Report
Robert Barnes 30 Oct. 1970 214 p refs
(Contract NAS9-9616)
(NASA-CR-114837) Avail: NTIS CSCL 11A

The steel-on-steel adhesive bonding technology of a new class of high temperature stable epoxy adhesive based on the monomer bis(epoxybutyl)carborane was developed. This monomer can be cured with conventional curing agents and reactive hardeners without the evolution of volatile by-products. Lap-shear strengths as high as 2180 psi were obtained at 500 F after aging at 500 F for eight hours in an air environment. The honeycomb bonding technology (stainless steel core and face sheets) was also developed. In beam flexure tests, ultimate loads of 1580 pounds and 805 pounds were obtained at 75 F and 500 F respectively. In sandwich peel tests, peel torque values of 6.5 and 3.1 inch pounds/inch width of specimen were obtained at 75 F and 500 F respectively. These values were obtained on a formulation which had not been modified with an anti-oxidant. Author

N71-16780# Wayne State Univ., Detroit, Mich. Dept. of Physics.
INVESTIGATION OF THE ATOMIC STRUCTURE AND THE NATURE OF THE MAGNETISM IN SEVERAL MAGNETIC GLASSES Final Progress Report
H. O. Hooper Sep. 1970 27 p refs
(Contract AT(11-1)-1700)
(COO-1700-16) Avail: NTIS

The atomic structure, magnetic properties and electrical properties of several highly paramagnetic and permanently magnetic glass samples have been determined. The structures and properties of these materials have been studied by techniques such as powder X-ray analysis, nuclear magnetic resonance, electron spin paramagnetic resonance, Mossbauer resonance, magnetization, magnetic susceptibility, and electrical conductivity. It has been found that highly paramagnetic samples of the system Fe2O3-Na2O-B2O3 can be prepared up to about 25 weight % Fe2O3. The electrical conductivity of the samples of the iron-sodium borate system appears to be related to the magnetic behavior. Most success was realized in the system CoO-Al2O3-SiO2 in which glasses of very high CoO content have been prepared. Amorphous samples of this system appear to have a good antiferromagnetic transition at very low temperatures and at very high CoO concentration with the ordering temperature increasing as the CoO concentration is reduced. Author (NSA)

N71-16782# Iowa State Univ. of Science and Technology, Ames.
SPECTROSCOPY OF MATRIX ISOLATED HIGH TEMPERATURE SPECIES. 1: THALLOUS HALIDES. 2: THALLOUS OXIDE
Joseph March Brom, Jr. (Ph.D. Thesis) Oct. 1970 114 p refs
(Contract W-7405-eng-82)
(IS-T-407) Avail: NTIS

The matrix isolation infrared spectra of the thallous halide and thallous oxide equilibrium vapors have been observed in rare-gas solids. Attention was focused on the Tl2X2 dimer molecules. On the basis of spectroscopic selection rules, the experimental results are in support of a proposed linear molecular configuration of Tl2F2 and Tl2Cl2. The results are shown to be consistent with the existing thermodynamic data for these species. The infrared spectra

observed for Tl2O are in support of a bent configuration of the molecule. On the basis of isotopic substitution experiments, it is shown that the spectra provide an estimate of the Tl-O-Tl apex angle of 90 deg. It is argued that the low bond angle is evidence for proposed metal-metal bonding in the thallous oxide molecule. Author (NSA)

N71-16786# Iowa State Univ. of Science and Technology, Ames.
HEAT CAPACITIES OF FOUR RARE EARTH TRICHLORIDE HEXAHYDRATES FROM 5 K TO 300 K
Donald Clarence Rulf (Ph.D. Thesis) Oct. 1970 128 p refs
(Contract W-7405-eng-82)
(IS-T-378) Avail: NTIS

Heat capacity measurements were made from 5 to 300 K on the trichloride hexahydrates of Gd, Tb, Ho and Lu. The lattice contributions to the heat capacities of the magnetic salts were obtained by using an interpolation between the Gd and the Lu salt. Subsequently determined crystal field splittings of the lowest J level were obtained for the Tb and Ho salts. These splittings were compared with extant optical spectral data. The entropies of the solutes for the above salts in aqueous solutions were determined using the present measurements and previous data from solution calorimetry. Author (NSA)

N71-16827# Wayne State Univ., Detroit, Mich.
MAGNETIZATION AND ELECTRICAL CONDUCTIVITY STUDIES OF SOME TRANSITION METAL OXIDE GLASSES
Robert M. Catchings, III (Ph.D. Thesis) 1970 138 p refs
(Contract AT(11-1)-1700)
(COO-1700-17) Avail: NTIS

Bulk magnetization versus temperature studies, nuclear magnetic resonance studies, and dc electrical conductivity studies were performed on the glass systems: iron-sodium borate, cobalt-aluminum silicate, and iron-lithium-sodium borate. The investigation was concerned with the study of magnetic ordering and electrical conduction in glasses. Glass samples were prepared containing large concentrations of some transition metal ions. Magnetic transitions, that were characteristic of an antiferromagnetic type of ordering, were observed in some of the glasses of the three systems studied. Also, some glass samples of the iron-sodium borate system were found to be semiconductors. Author (NSA)

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N71-16712# National Physical Lab., Teddington (England). Div. of Electrical Science.
SOME METHODS OF SOLUTION OF LINEAR ORDINARY LOGICAL DIFFERENTIAL EQUATIONS
J. E. Gibbs and Margaret J. Millard Dec. 1969 36 p refs
(NPL-DES-2) Copyright. Avail: NTIS

Discrete Walsh-Paley functions, defined for a set of non-negative integers Bn, play a part in the solutions of discrete logical differential equations analogous to that of the exponential function in those of ordinary differential equations. The Walsh-Paley functions form a complete orthonormal set on Bn, and any other function with the same domain of definition may be expressed as a linear combination of them. Some important differences encountered in solving ordinary linear logical differential equations with constant coefficients compared with solving ordinary differential equations e.g. a homogeneous equation of order q does not always have q linearly independent solutions, are discussed. Author (ESRO)

N71-16831 Padua Univ. (Italy). Inst. di Fisica.
CONSTRAINTS ON EQUAL TIME COMMUTATORS FROM LORENTZ CONVARIANCE
G. Sartori [1970] 8 p refs Prepared jointly with Ist. Nazl. di Fis. Nucl., Padua
(IFPTH-6/70) Avail: AEC Depository Libraries

Constraints on equal-time commutators are rederived by means only of group theoretical techniques implemented by the use of some formal properties Sigma sub n commutators. In order to avoid the formal difficulties connected with half-integer spins the constraints are proven only in the case of two tensor local operators. The results justify the extensive exploitation of these constraints made in previous work. NSA

N71-16848*# Maryland Univ., College Park. Computer Science Center.
APPLICATIONS OF PARTIAL ORDERINGS TO THE STUDY OF POSITIVE DEFINITENESS, MONOTONICITY, AND CONVERGENCE OF ITERATIVE METHODS FOR LINEAR SYSTEMS
James S. Vandergraft Sep. 1970 18 p refs
(Grant NGL-21-002-008)
(NASA-CR-116134; TR-70-137) Avail: NTIS CSCL 12A

An important link between convergence theory, monotonicity, and positive definiteness is introduced called K-semi positivity. This concept is defined and several fundamental facts are proved, using the theory of partial orderings. Finally, applications of these results to Jacobi's method and the theory of regular splittings are submitted. E.M.C.

N71-16932*# Maryland Univ., College Park. Computer Science Center.
THINNING ALGORITHMS ON RECTANGULAR, HEXAGONAL AND TRIANGULAR ARRAYS
E. S. Deutsch Jun. 1970 35 p refs
(Grant NGL-21-002-008; Contract AT-(40-1)-3882)
(NASA-CR-116131; TR-70-115) Avail: NTIS CSCL 12A

Three thinning algorithms are developed; one each for use with rectangular, hexagonal and triangular arrays. The approach to the development of each algorithm is the same. Pictorial results produced by each of the algorithms are presented and the relative performances of the latter are compared. It is found that the algorithm operating with the triangular array is the most sensitive to image irregularities and noise. Yet it will yield a thinned image with an over-all reduced number of points. It is concluded that the algorithm operating in conjunction with the hexagonal array has features which strike a balance between those of the other two. Author

N71-16943*+ Tuskegee Inst., Ala. Dept. of Electrical Engineering.
THE SCHWAIGERIAN DRIVER TRANSFER TECHNIQUE AND THE THEVENIN'S AND THE NORTON'S THEOREM Final Report
M. R. A. Erdey and J. L. Ding [1969] 18 p refs
(Grant NGR-01-005-004)
(NASA-CR-116118) Avail: NTIS CSCL 12A

The graphical technique of Schwaiger for analyzing series-parallel networks by rectangular diagrams is studied as an indirect form for solving problems in power distribution systems. In linear resistive networks, each power element is represented by a component of the rectangle: the vertical side represents voltage; the horizontal side represents current; and the power is given by the area. The Schwaigerian graphical drive transfer technique is also demonstrated, and the general cases of the Thevenin and the Morton theorems are proved. F.O.S.

N71-15947# Technische Hochschule Hannover (West Germany).
SEQUENTIAL TESTING METHODS WITH EMPHASIS ON BAYES BASIS [SEQUENTIELLE TESTMETHODEN, INSBESONDERE AUF BAYESSCHER GRUNDLAGE]
Dietrich Grude (Ph.D. Thesis) 1970 72 p refs In GERMAN
Avail: NTIS

A new sequential test is described that is based on the Bayes theorem. The test is optimal for problems that demand minimal random sampling and make decisions by using Neyman-Pearson theory with error probabilities. It is shown that this particular test always exists under certain conditions and that it reaches a decision at a probability of 1. Transl. by G.G.

N71-15976# Technische Hochschule Hannover (West Germany).
ON THEORY AND APPLICATION ON NON-GAUSSIAN STOCHASTIC PROCESSES [ZUR THEORIE UND ANWENDUNG NICHT-GAUSSSCHER STOCHASTISCHER VORGAENGE]
Burkhart Kuehl (Ph.D. Thesis) 1970 105 p refs In GERMAN
Avail: NTIS

Optimal detection of signals in non-Gaussian stochastic noise problems is considered for: (1) non-Gaussian processes with unknown development mechanisms; (2) realization of optimal detection systems in Gaussian and non-Gaussian noises; and (3) deterioration of gauss noise optimal detection system at typical non-Gaussian noises so that the system establishes linear transformation at small expenditure. Statistic communication theoretical methods are used to develop an approximation with orthogonal polynomials to obtain Bayes receiver systems that change the median risk to a minimum during signal detection and parametric extraction. Transl. by G.G.

N71-16007*# Maryland Univ., College Park. Computer Science Center.
A CLASS OF NONLINEAR FUNCTIONS AND THE CONVERGENCE OF GAUSS-SEIDEL AND NEWTON-GAUSS-SEIDEL ITERATIONS
Jorge J. More Jul. 1970 95 p refs
(Grants NGL-21-002-000; NSF GJ-231)
(NASA-CR-116129; TR-70-123) Avail: NTIS CSCL 12A

The main class of these functions is a generalization of the P-matrices of Fiedler and Ptak. It is shown that the strictly monotone mappings, as well as the M-functions, are special cases of these P-functions, and that the inverse isotone mappings are closely related to them. Then a generalization of the strictly and irreducibly diagonally dominant matrices is introduced, and these irreducibly diagonally dominant functions are likewise shown to be closely related to P-functions. For an irreducibly diagonally dominant function F, the nonlinear generalizations of Jacobi and Gauss-Seidel iterations due to Bers are then studied, and convergence results analogous to those available for strictly and irreducibly diagonally dominant matrices are obtained. Author

N71-16008*# Maryland Univ., College Park. Computer Science Center.
ON P- AND S-FUNCTIONS AND RELATED CLASSES OF n-DIMENSIONAL NONLINEAR MAPPINGS
Jorge J. More and Werner C. Rheinboldt Jul. 1970 38 p refs
(Grants NGL-21-002-008; NSF GJ-231)
(NASA-CR-116133; TR-70-120) Avail: NTIS CSCL 12A

This paper introduces and analyzes certain classes of mappings on the n-dimensional real linear space which represent nonlinear generalizations of the P- and S-matrices of Fiedler and Ptak, and of several closely related types of matrices. As in the case of the corresponding matrices, these nonlinear P- and S-functions arise frequently in applications. Basic properties of the different functions and of their inverses and subfunctions are established, and then a number of theorems are proved about the interrelationships between the various mappings. In particular, it is shown that the well-known monotone mappings, as well as the M-functions and certain strictly diagonally dominant mappings, are special cases of the P-functions. In turn, these P-functions and also the inverse isotone mappings are subclasses of the S-functions. A series of characterization theorems for the different functions are presented in terms of conditions on their derivatives. Author

N71-16036*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
SUM RULE FUNCTIONS, 1
Michael Fielding Barnsley 14 Sep. 1970 60 p refs
(Grants NGL-50-002-001; NSF GP-12832)
(NASA-CR-116138; WIS-TCI-394) Avail: NTIS CSCL 12A

The problem of bounding sum rules in terms of other sum rules and the problem of interpolation between sum rules are dealt with. It is shown how the problem of sum rule interpolation can be approached in such a way that the best possible bounds are obtained to all quantum mechanical sum rules, based on any given set of sum rules. An explicit construction for the interpolation functions for a large class of given sets of sum rules is presented. The manner in which such constructions may be applied to other sets of given sum rules is shown. D.L.G.

N71-16276*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
THE FIRST ORDER WAVE FUNCTION IN THE 1/Z EXPANSION
Saul T. Epstein 14 Nov. 1968 7 p
(Grant NGL-50-002-001)
(NASA-CR-116126; WIS-TCI-328) Avail: NTIS CSCL 12A

A simplified method is presented for the derivation of the form of the first order wave function in the 1/Z expansion. The method most closely resembles that of Sinanoglu. D.L.G.

N71-16384# RAND Corp., Santa Monica, Calif.
THE APPLICATION OF INVARIANCE TO UNBIASED ESTIMATION
Morris L. Eaton and Carl N. Morris Oct. 1970 27 p refs
(Contract F44620-67-C-0045)
(AD-714067; R-592-PR) Avail: NTIS CSCL 12/1

A relatively easy method is discussed for constructing minimum variance unbiased estimates of nonstandard parametric functions under a variety of statistical model assumptions. The most important assumption is that the family of given distributions be invariant under a group of transformations. Estimation of the reliability function of an aircraft is an important application, as is estimation of moments of transformed data. The results are applied to unbiased estimation in the multivariate normal distribution and to a problem involving U-statistics. Author (GRA)

N71-16498*# Institute of Modern Languages, Inc., Washington, D.C. Translation and Interpretation Div.
CONVERGENCE AND MEAN SQUARE ERROR ESTIMATION IN SOLUTION OF PARTICULAR BOUNDARY-VALUE PROBLEMS FOR ELLIPTICS EQUATIONS BY THE STRAIGHT-LINE METHOD [SKHODIMOST I SREDENKVADRATICHNAYA OSTENKA POGRESHNOSTI PRI RESHENII NEKOTORYKH KRAEVYKH ZADACH DLYA ELLIPTICHESKIKH URAVNENIY METODOM PRYAMYKH]
V. N. Abrashin NASA Jan. 1971 5 p refs Transl. into ENGLISH from Dokl. Akad. Nauk Belorussk. SSR, v. 11, no. 8, 1967 p 670–672 Sponsored by NASA

(NASA-TT-F-11452) Avail: NTIS CSCL 12A

The pattern of the straight line method was considered for an elliptical equation with two independent variables. The result was generalized for the case of an equation with a number of independent variables greater than two. The straight line method passed into the hyperplane method. Author

N71-16497*# Bellcomm, Inc., Washington, D.C.
A FINITE DIFFERENCE SOLUTION TO A MIXED BOUNDARY VALUE PROBLEM FOR LAPLACE'S EQUATION
V. Thuraisamy and S. C. Chu 28 Dec. 1970 26 p refs
(Contract NASw-417)
(NASA-CR-116225; TM-70-1022-20) Avail: NTIS CSCL 12A

This problem arises in the analysis of longitudinal vibrations of tanks, partially filled with fluid. The discretization process presented permits both equal-size and variable mesh grids. The convergency property of the process is proved. Author

N71-16501*# Scientific Translation Service, Ann Arbor, Mich.
CERTAIN UNSOLVED PROBLEMS OF AUTOMATIC CONTROL THEORY [NEKOTORYYE NERESHENNYYE ZADACHI TEORII AVTOMATICHESKOGO UPRAVLENIYA]
A. M. Letov Jan. 1971 43 p refs Transl. into ENGLISH from Differentsial'nye Uravnaniya (USSR), v. 6, Apr. 1970 p 592–615
(Contract NASw-2035)
(NASA-TT-F-13435) Avail: NTIS CSCL 12A

A method of solving the problem of synthesizing asympotically stable closed systems is outlined, and a situation leading to the formulation of so-called mixed problems of optimal control theory is described. Author

N71-16573*# Georgia Inst. of Tech., Atlanta. School of Electrical Engineering.
DIFFERENCE EQUATIONS TO APPROXIMATE ORDINARY DIFFERENTIAL EQUATIONS
Joseph L. Hammond, Jr. 24 Sep. 1970 44 p refs
(Contract NAS8-2473)
(NASA-CR-103015; GIT/EES-A585/T22; TN-22) Avail: NTIS CSCL 12A

One-step and multistep numerical methods are reviewed with the objective of developing a tractable method for evaluating the error resulting from the use of difference equations to approximate ordinary differential equations. A tractable approximate relation is developed between the error due to finite sampling rates and parameters describing numerical methods. The results are valid for small values of the product of the sampling period, and natural frequencies of the analog system. The approach used approximates the analog system by isolated modes and the digital algorithm for each mode by its order, p, and certain constants C. A sub o, ... A sub p. The results show that approximating an analog system by a digital algorithm results in a shift of each root and an error corresponding to each forcing function. Author

N71-16601# State Univ. of New York, Binghamton.
A NOTE ON CYCLIC SUBELEMENT THEORY: REDUCIBILITY OF LOCAL CONNECTEDNESS AND LOCAL SIMPLE CONNECTEDNESS
L. F. McAuley and G. L. McAllister [1970] 11 p refs
(Grant NSF GP-6951)
Avail: Issuing Activity

The property of being a plane, locally connected, Peano continuum is shown to be subelement reducible. Starting with an example of a locally simply connected Peano continuum in E to the 3rd power with a subelement that is not locally connected, a proof of the equivalence, in the plane only, of two forms of local-simple connectedness is developed. F.O.S.

N71-16617# Massachusetts Inst. of Tech., Cambridge. Dept. of Mathematics.
APPLICATIONS OF GLOBAL ANALYSIS TO MODERN THEORETICAL PHYSICS Final Report
I. E. Segal 30 Sep. 1970 10 p refs
(Contract F44620-67-C-0008)
(AD-714581; AFOSR-70-2536TR) Avail: NTIS CSCL 20/10

The report summarizes the results of research related to the development of sound and effective methods for the treatment of the basic non-linear partial differential equations of contemporary theoretical physics. A list of relevant publications is also provided. Author (GRA)

N71-16673*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMPUTATION AND ANALYSIS
In its Space Programs Sum. No. 37-65, Vol. 3, Aug.–Sep. 1970 31 Oct. 1970 p 3–11 refs (See N71-16671 08-30)
Copyright. Avail: NTIS CSCL 12A

A high-speed, variable accuracy method was developed for computing ordered sequences of the incomplete gamma function. The primary emphasis was placed on sequence evaluation in order to provide an efficient, quick method for summing series involving incomplete gamma (or its complement) and producing either low- or high-accuracy tables of values. In the process of constructing an optimal method, two procedures are discussed which may have applications beyond this particular problem. Author

N71-16777# National Meteorological Center, Suitland, Md.
A STUDY OF NONLINEAR COMPUTATIONAL INSTABILITY FOR A TWO-DIMENSIONAL MODEL
Paul D. Polger Feb. 1971 26 p refs
(NOAA-TM-NWS-NMC-49) Avail: NTIS

Experiments were conducted to test methods of achieving stability for three finite-difference analogues to a two-dimensional system of forecast equations. The equations described barotropic motion in an inviscid, incompressible, hydrostatic fluid with a free surface. The primary integration procedure was the leapfrog method. The measure of stability of the model was defined as a function of the available energy. No significant suppression of instability was achieved solely through manipulation of the boundary conditions of the finite-difference formulations. Increased stability was achieved for an invariant form of the forecast equations by applying initial data derived from an initialization procedure consistent with the formulation of the forecast system. A significant increase in stability was obtained by applying a space-time averaging operator to the advective coefficient of the non-linear terms of an advective form of the primitive equations. The result lends experimental support to extending a theory of non-linear computational instability in one dimension to two dimensions. Author

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N71-16708# Institut Royal Meteorologique de Belgique, Brussels. Inst. d'Hygiene et d'Epidemiologie.
ATMOSPHERIC POLLUTION, SMOKE, AND SULFUR DIOXIDE Monthly Bulletin, Mar. 1970 [POLLUTION ATMOSPHERIQUE, FUMEE ET ANHYDRIDE SULFUREUX Bulletin Mensuel, Mars 1970]
1970 30 p In FRENCH and DUTCH
Avail: NTIS

Data obtained at Belgian weather stations in March 1970 are tabulated. The air pollution apparatus is briefly described. ESRO

N71-15710# Institut Royal Meteorologique de Belgique, Brussels.
ATMOSPHERIC POLLUTION, SMOKE, AND SULFUR DIOXIDE Monthly Bulletin, Feb. 1970 [POLLUTION ATMOSPHERIQUE, FUMEE ET ANHYDRIDE SULFUREUX Bulletin Mensuel, Fevrier 1970]
1970 29 p In FRENCH and DUTCH
Avail: NTIS

Data obtained at Belgian weather stations in February 1970 are tabulated. The air pollution apparatus is briefly described. ESRO

N71-15711# Institut Royal Meteorologique de Belgique, Brussels.
CLIMATOLOGICAL OBSERVATIONS Monthly Bulletin, Sep. 1970 [OBSERVATIONS CLIMATOLOGIQUES Bulletin Mensuel, Septembre 1970]
1970 16 p In FRENCH and DUTCH
Avail: NTIS

Meteorological parameters observed at different Belgian weather stations during September 1970 are given. ESRO

N71-15755 World Meteorological Organization, Geneva (Switzerland). Joint Organizing Committee for GARP.
REPORT OF THE FOURTH SESSION OF THE JOINT GARP ORGANIZING COMMITTEE
1970 125 p refs Conf. held at Moscow, 1–5 Jun. 1970 Prepared jointly with Intern. Council of Sci. Unions
Avail: Issuing Activity

Discussions on numerical experiments, radiation aspects, tropical experiments in the Atlantic Ocean, global experiments, and air-surface interactions are recorded. There are also ten annexes on these and administrative topics. ESRO

N71-15760# Israel Program for Scientific Translations, Ltd., Jerusalem.
CLIMATOLOGIC AND CIRCULATION EPOCHS IN THE NORTHERN HEMISPHERE IN THE FIRST HALF OF THE 20th CENTURY
M. E. Lyakhov, ed. 1970 163 p refs Transl. into ENGLISH of the book 'Tsirkulyatsionnye i Klimaticheskie Epokhi Severnogo Polushariya v Pervoi Polovine 20 Veka' Moscow, Izdatelstvo Nauka, 1968 163 p Sponsored in part by ESSA and NSF
(TT-70-50056; Rept-13) Copyright. Avail: NTIS

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7. THE CAUSES OF CHANGES IN PRECIPITATION AMOUNTS IN EAST SIBERIA N. K. Kononova p 104–115 refs (See N71-15767 06-20)

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10. RELATIONSHIP BETWEEN ELEMENTARY CIRCULATION MECHANISMS AND THE LOCAL WEATHER CONDITIONS DURING JANUARY IN THE REGION OF MOSCOW L. S. Potapova p 139–153 refs (See N71-15770 06-20)

11. RELATIONSHIPS BETWEEN PHENOLOGICAL EVENTS AND CLIMATIC FLUCTUATIONS (BASED ON DATA FOR EUROPEAN USSR) V. I. Dolgoshov et al p 154–158 refs (See N71-15771 06-20)

N71-15761# Israel Program for Scientific Translations, Ltd., Jerusalem.
ATMOSPHERIC CIRCULATION REGIME AND ITS RELATION TO MEAN MONTHLY AIR TEMPERATURE ANOMALIES
A. S. Chaplygina *In its* Climatological and Circulation Epochs in the Northern Hemisphere in the First Half of the 20th Century 1970 p 3–15 refs (See N71-15760 06-20)
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The study of circulation conditions over the Northern Hemisphere has shown that the difference between the meridional (1899 through 1923) and the zonal (1924 through 1953) epochs by the character of the dominating elementary circulation mechanisms (ECM) (zonal and meridional), as well as by the structure of seasons (contribution of the winter, summer and transitional ECM), were most clearly expressed during the cold part of the year (early winter, winter, early spring). During these seasons, most evident were the connections between the changes in the circulation conditions and the changes in the most frequently observed distribution of signs of intensive anomalies of the mean monthly air temperature, which are analyzed separately for six sectors of the Northern Hemisphere. During the second epoch, the reduction in the total duration of the meridional processes and the displacement of the center of the circumpolar region of high pressure toward the North American sector has caused a more frequent formation of intensive positive temperature anomalies in the winter and early winter months in the Far East and Pacific sectors. The same causes led also to a more frequent appearance of intensive negative temperature anomalies during the early spring months in the Far East, Pacific, and Atlantic sectors. Author

N71-15762# Israel Program for Scientific Translations, Ltd., Jerusalem.
FREQUENCY AND SEQUENCE OF ALTERNATIONS BETWEEN ELEMENTARY CIRCULATION MECHANISMS IN THE WINTER SEASON
A. S. Chaplygina *In its* Climatological and Circulation Epochs in the Northern Hemisphere in the First Half of the 20th Century 1970 p 16–28 refs (See N71-15760 06-20)
Copyright. Avail: NTIS

From data on the frequency distribution and the sequence of mutual transformations of different subtypes of elementary circulation mechanisms and of their groups, active in the winter seasons during two circulation epochs (meridional, 1899 to 1923, and zonal, 1924 to 1954), schemes of the most probable succession

of the violation regions of the zonal ring of cyclonic activity (Arctic intrusions) during these seasons were compiled. The major changes in winter circulation conditions from the first epoch to the second were expressed by the reduction in the frequency of intrusions associated with the Asiatic blocking anticyclone in two, and especially in three directions. At the same time the frequency of blockings over the American continent and of zonal processes increased. On this basis it might be supposed that the activity of the polar and Asiatic anticyclones in the second (zonal) epoch was reduced, while the recurrence and intensity of high-pressure regions over North America increased. The most conspicuous changes in the distribution and intensity of the major centers of atmospheric activity have occurred in the eastern half of the Northern Hemisphere, which explains changes in the temperature regime of the winter season of the Far East and Pacific sectors of the Northern Hemisphere. Author

N71-15763# Israel Program for Scientific Translations, Ltd., Jerusalem.

AN EXPERIMENTAL DETERMINATION OF THE ENERGY OF ATMOSPHERIC PROCESSES IN WINTER OVER THE NORTHERN HEMISPHERE

L. V. Khmelevskaya *In its* Climatological and Circulation Epochs in the Northern Hemisphere in the First Half of the 20th Century 1970 p 29–40 refs (See N71-15760 06-20)

Copyright. Avail: NTIS

The analysis and comparison of spatial distribution and storage of internal and kinetic energy in an atmospheric column for January 1950 and 1963, which were characterized by very low temperatures in European USSR and in western Siberia, and for January 1961 and 1962, when the air temperature over these territories was much higher than the average for many years, shows a sudden violation of the zonal distribution nature of the energy characteristics over regions of extreme cooling and considerable decrease in energy resources in anomalous cold periods. The close interrelation revealed between the changes in values of internal and kinetic energy and the duration of the effect of different circulation types support the objectiveness of such a system from the energetical point of view, and the correct compilation of the calendar of elementary circulation mechanisms on its basis. Author

N71-15764# Israel Program for Scientific Translations, Ltd., Jerusalem.

CLIMATIC DIFFERENCES IN EXTREME DECADES AS A RESULT OF THE DISPLACEMENT OF THE AXES OF ARCTIC INTRUSIONS

S. S. Savina *In its* Climatological and Circulation Epochs in the Northern Hemisphere in the First Half of the 20th Century 1970 p 41–48 refs (See N71-15760 06-20)

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The displacement of the axes of the Arctic intrusions during the activity of elementary circulation mechanism subtypes 11a, 5a, 5b, 5d (winter), and 4b, 4c, 7aS, 7bS, 10a, 10b (summer) in extreme decades is determined. The displacement is shown of baric regions of one and the same sign from the first decade to the second during the days of activity of subtypes 11a, 4b, and 4c. The overlap zones are recognized, and are characterized by a change in the prevalent baric regime and weather. Climatic differences are revealed at a number of locations and regions located in the overlap zones, and are observed on days of activity of the mentioned elementary circulation mechanism subtypes from the first decade to the second. Author

N71-15765# Israel Program for Scientific Translations, Ltd., Jerusalem.

WINTER CIRCULATION AND METEOROLOGICAL CONDITIONS IN THE FAR EAST SECTOR DURING TWO EPOCHS

A. S. Chaplygina *In its* Climatological and Circulation Epochs in the Northern Hemisphere in the First Half of the 20th Century 1970 p 48–81 refs (See N71-15760 06-20)

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Analysis of relations between circulation conditions and the intensive anomalies of air temperature, conducted on the basis of the observation material obtained at a number of stations in the Far East sector of the Northern Hemisphere, shows that the character of these relations for one and the same elementary circulation mechanism (ECM) changes from one circulation epoch to another. The changes depend on the changes of the position and intensity characteristics of the main predominant centers of action in each epoch. This results in changes in the position and intensity of the cyclonic activity ring located in the middle latitudes of the hemisphere. The ECM can be chosen for any part of the Northern Hemisphere, when the temperature conditions in this region are especially sensitive to relatively small changes in the system of the general circulation, and grouped in accordance with the similarity in this reaction. Thus for the Far East sector the anomalously low mean monthly air temperatures in winter of the meriodional epoch and the anomalously high temperatures in the winter months of the zonal epoch depended on the character of interrelations of the Icelandic and Aleutian lows, of the Asiatic and polar anticyclones. Author

N71-15766# Israel Program for Scientific Translations, Ltd., Jerusalem.

FLUCTUATIONS OF THE ATMOSPHERIC CIRCULATION AND AIR TEMPERATURE IN EAST SIBERIA

N. K. Kononova *In its* Climatological and Circulation Epochs in the Northern Hemisphere in the First Half of the 20th Century 1970 p 82–103 refs (See N71-15760 06-20)

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In the first half of the 20th century in East Siberia, as on the whole Northern Hemisphere, two circulation epochs, meridional and zonal, existed. The epochs as a whole were not analyzed, only the extreme decades. The extreme decade for the first half of the epoch is 1906 through 1915; for the second half it is 1944 through 1953. The succession of the meriodional circulation epoch by the zonal one was accompanied by an increase in air temperature. For the whole territory, according to data obtained at 24 stations, the mean annual air temperature for the second decade was 0.8 degrees higher than for the first. The greatest increase in air temperature occurred during the periods of early winter and early spring. The annual temperature range was 0.6 degrees lower. Author

N71-15767# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE CAUSES OF CHANGES IN PRECIPITATION AMOUNTS IN EAST SIBERIA

N. K. Kononova *In its* Climatological and Circulation Epochs in the Northern Hemisphere in the First Half of the 20th Century 1970 p 104–115 refs (See N71-15760 06-20)

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The connection between changes in the amount of precipitation and the character of the circulation was analyzed for the extreme decades of the two circulation epochs, 1906 through 1915 and 1944 through 1953. The warm period with more than three-quarters of the annual amount of precipitation is studied in detail. It is shown that in different parts of East Siberia precipitation is associated with different circulation, precipitation-forming types. The territory of East Siberia is divided into five parts according to precipitation circulation types. A close relation is determined between the change in the amount of precipitation from epoch to epoch and the change in the total duration and set of precipitation-forming circulation types. Author

N71-15768# Israel Program for Scientific Translations, Ltd., Jerusalem.

COMPARATIVE DESCRIPTION OF EXTREMAL PERIODS OF CIRCULATION EPOCHS OVER EUROPEAN SSSR AND WEST SIBERIA

S. S. Savina *In its* Climatological and Circulation Epochs in the Northern Hemisphere in the First Half of the 20th Century 1970 p 116-123 refs (See N71-15760 06-20)

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The differences in the radiation balance for warm and cold season, between precipitation totals for the warm season, and in temperature totals above 10 degrees between the 1906 and 1915 and 1931 and 1940 decades were found to be appreciable. These are due to the different frequencies and duration of types of elementary circulation mechanisms (ECM) during these decades. A relationship is established between changes in climatic features and types of ECM showing that the latter make a determining contribution to the climatological-regime fluctuations of the 20th century over European USSR and West Siberia. Author

N71-15769# Israel Program for Scientific Translations, Ltd., Jerusalem.

RELATIONSHIP BETWEEN CIRCULATION TYPES AND ANOMALIES OF MONTHLY AVERAGE TEMPERATURES AND PRECIPITATION OVER EUROPEAN USSR

K. V. Kuvshinova *In its* Climatological and Circulation Epochs in the Northern Hemisphere in the First Half of the 20th Century 1970 p 124-138 refs (See N71-15760 06-20)

Copyright. Avail: NTIS

Circulation conditions are considered for the formation of negative and positive air-temperature and precipitation anomalies in European USSR during the two epochs 1901 through 1920 and 1921 through 1940. Differences are detected in the formation of air-temperature anomalies during the first and second epochs. A tendency is found toward reduction in the annual amount of precipitation at a number of stations of European USSR during the second epoch as a result of an increase in the number of days with anticyclonic circulation, in conjunction with growth in the western zonal circulation. Author

N71-15770# Israel Program for Scientific Translations, Ltd., Jerusalem.

RELATIONSHIP BETWEEN ELEMENTARY CIRCULATION MECHANISMS AND THE LOCAL WEATHER CONDITIONS DURING JANUARY IN THE REGION OF MOSCOW

L. S. Potapova *In its* Climatological and Circulation Epochs in the Northern Hemisphere in the First Half of the 20th Century 1970 p 139-153 refs (See N71-15760 06-20)

Copyright. Avail: NTIS

Statistical relationships between January weather in Moscow and types of atmospheric circulation are established by analyzing the local-weather catalog collected at the Mikhel'son Observatory, the calendar of elementary circulation mechanisms (ECM) and composite kinematic charts for the period from 1899 to 1954, as well as data of the many-year circulation variation by decade sliding averages for the European sector. Three decades with different circulation processes were selected from this period. Western zonal circulation with predominant frequency (44%) of subtype 11a circulation is most typical of the 1904 through 1913 decade. It is accompanied by primarily moderate and heavy frost with a frequency of 73%. The correlation factor between western zonal processes and classes of weather with moderate frost is 0.52 to 0.55. Southern meridional processes with subtypes 5b and 12bW with a frequency of 36% each were most frequently noted during the 1923 to 1933 decade. Weather with air temperatures passing through zero, and with slight and moderate frost with total frequency of 80% predominate. Northern meridional processes with subtype 12cW, whose frequency was 55%, as well as heavy and hard frost with a frequency of 53% were typical of the 1940 through 1949 decade. The correlation factors between northern meridional processes and classes of weather with heavy frost are as high as 0.75 to 0.81. Author

N71-15771# Israel Program for Scientific Translations, Ltd., Jerusalem.

RELATIONSHIPS BETWEEN PHENOLOGICAL EVENTS AND CLIMATIC FLUCTUATIONS (BASED ON DATA FOR EUROPEAN USSR)

V. I. Dolgoshov et al *In its* Climatological and Circulation Epochs in the Northern Hemisphere in the First Half of the 20th Century 1970 p 154-158 refs (See N71-15760 06-20)

Copyright. Avail: NTIS

Observed phenological data (dates of the start of blossoming of certain tree and herb species, return of migratory birds, start of some kinds of field work) pertaining to climatic epochs and their extremal decades in European USSR are compared. A marked shift is established in the dates when these phenological events occur for the first time, which is in satisfactory agreement with changes in the climatic conditions of the above periods. Author

N71-15804# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

PHYSICAL CHARACTERISTICS OF THE SNOW COVER FORT GREELY, ALASKA, 1966-1967

Michael A. Bilello, Roy E. Bates, and James Riley Sep. 1970 38 p refs

(AD-714646; CRREL-TR-230) Avail: NTIS CSCL 8/12

Observations were made at 19 sites in and around the Fort Greely Military Reservation in Alaska during the winter of 1966-67 to obtain data on the depth and physical properties of the snow cover. Snowfall in 1966-67 totaled 245 cm, which was more than 2-1/2 times the seasonal normal. Maximum snow depths of 80 to 100 cm were observed in a major portion of the reservation. Measurements at nine sites showed that the snow density at Fort Greely was generally light; e.g., the average density in the forest did not exceed 0.24 g/cu cm. However, exceptions such as at Jarvis Creek, where the density averaged 0.33 g/cu cm, could be expected. On the average, less snow falls at Fort Greely than at other interior Alaskan locations; but the average density of the snow cover at all interior Alaska sites is quite light. Relationships between snow-cover properties and climate were tested using data collected at Fort Greely. The results substantiated the relationships between (1) snow hardness and snow density measurements and (2) average snow densities with average windspeed and air temperatures. Snow temperature measurements at Fort Greely showed that the snow in the forest was colder than at exposed sites, primarily because the average air temperature within the forest canopy was lower than that in the open area. Author (GRA)

N71-15905# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

PHYSICAL PROPERTIES OF THE SNOW COVER AND CLIMATIC CONDITIONS AT LEBANON, NEW HAMPSHIRE AND VICINITY

Roy E. Bates Sep. 1970 29 p refs

(AD-714645; CRREL-SR-143) Avail: NTIS CSCL 4/2

The characteristics of the snow cover at Lebanon Regional Airport, New Hampshire and vicinity for the three winters between 1964 and 1967 were investigated. Report includes information on snowfall amounts, snow depth, snow hardness, snow density, and water equivalent. Meteorological data and snow and ground temperatures were also investigated. A mean annual snowfall map for northern New England was developed. Relationships between snow density and climate were investigated. Wind and air

temperature data were used to estimate values of snow density; these values were on the average 14% less than the observed values. The mean snow density for the three winters studied was 0.272 g/cu cm; the mean snow-cover hardness was 885 g/sq cm; the average water equivalent of the snow at Lebanon Regional Airport at the time of maximum snow depth was 8 cm; and the average temperature gradient through the snow cover was 0.4 C/cm.
Author (GRA)

N71-15933 Freie Univ., Berlin (West Germany). Inst. for Meteorology and Geophysics.
METEOROLOGICAL DATA. VOLUME 116, NO. 2: DAILY ALTITUDE MAPS OF THE 100 mb LEVEL AND THE 50 mb LEVEL AS WELL AS MONTHLY MEAN MAPS FOR 1970, PART 2 Quarterly Report [METEOROLOGISCHE ABHANDLUNGEN. BAND 116, HEFT 2: TAEGLICHE HOEHENKARTEN DER 100-mb-FLAECHE UND DER 50-mb-FLAECHE SOWIE MONATLICHE MITTELKARTEN FUER DASJAHR 1970 TEIL 2, 2. VIERTELJAHR]
Barbara Kriester, Karin Labitzke, Renate Lenschow, Wolfgang Roeder, Richard Scherhag et al 1970 125 p In GERMAN; ENGLISH summary
(QR-2-Pt-2) Avail: Issuing Activity

Daily height and temperature analyses of constant pressure levels for three months for the Northern Hemisphere, based on rawinsonde and rocketsonde data and performed with the aid of a hydrostatic buildup method are presented. The corresponding monthly mean maps, and their variations and deviations are included as well as the mean gridpoint data, calculated from daily values. The stratospheric circulation of polar, middle, and tropical latitudes is also described for the period under consideration.
Author

N71-15934# Freie Univ., Berlin (West Germany). Inst. for Meteorology and Geophysics.
METEOROLOGICAL DATA. VOLUME 73, NO. 1: INTERPRETATION OF SATELLITE PHOTOGRAPHS OF THE EARTH'S SURFACE [METEOROLOGISCHE ABHANDLUNGEN. BAND 73, HEFT 1: DIE INTERPRETATION VON SATELLITENAUFNAHMEN DAS BILD DER ERDOBERFLAECHE]
Ingrid Haupt 1970 327 p refs In GERMAN; ENGLISH summary
Avail: Issuing Activity

The pictures chosen were mainly supplied by the weather satellites of the TIROS, NIMBUS, and ESSA series. In special cases and for purposes of comparison, pictures taken during manned space flights in the Gemini program and those taken by the Applicstions Technology Satellites (ATS) have been referred to as well. Pictures are used which show little or no clouding. Some examples show that orographical conditions such as islands distinguish themselves by means of meteorological phenomena. Techniques are presented for quick localization and interpretation of the pictures. A comprehensive collection of single pictures and a detailed description of the shape and nature of the surface as well as the relations of the vegetation in the European, Asian and African sphere are given. The duration and extent of snow and ice conditions are indicated to clarify the difficult distinction between snow, ice, and clouds.
Author

N71-15956+ Freie Univ., Berlin (West Germany). Inst. for Meteorology and Geophysics.
METEOROLOGICAL DATA. VOLUME 117, No. 2: DAILY ALTITUDE MAPS OF THE 30 mb LEVEL AS WELL AS MONTHLY MEAN MAPS FOR 1970, PART 2 Quarterly Report [METEOROLOGISCHE ABHANDLUNGEN. BAND 117, HEFT 2: TAEGLICHE HOEHENKARTEN DER 30-mb-FLAECHE SONIE MONATLICHE MITTELKARTEN FUER DASJAHR 1970 TEIL 2, 2. VIERTELJAHR]
Krista Hollan, Barbara Kriester, Karin Labitzke, Renate Lenschow, Karin Petzold et al 1970 108 p In GERMAN; ENGLISH summary
(QR-2-Pt-2) Avail: NTIS

Daily height and temperature analyses of constant pressure-levels for three months for the whole of the Northern Hemisphere, based on rawinsonde and rocketsonde data and performed with the aid of a hydrostatic buildup method are presented. The corresponding monthly mean maps, and their variations and deviations are included as well as the mean gridpoint data, calculated from daily values. The stratospheric circulation of polar, middle, and tropical latitudes is also described for the period under consideration.
Author

N71-15957+ Freie Univ., Berlin (West Germany). Inst. for Meteorology and Geophysics.
METEOROLOGICAL DATA. VOLUME 116, NO. 1: DAILY ALTITUDE MAPS OF THE 100 mb LEVEL AND THE 50 mb LEVEL AS WELL AS MONTHLY MEAN MAPS FOR 1970, PART 1 Quarterly Report [METEOROLOGISCHE ABHANDLUNGEN. BAND 116, HEFT 1: TAEGLICHE HOEHENKARTEN DER 100-mb-FLAECHE UND DER 50-mb-FLAECHE SOWIE MONATLICHE MITTELKARTEN FUER DASJAHR 1970. TEIL 1, 1 VIERTELJAHR]
Barbara Kriester, Karin Labitzke, Renate Lenschow, Wolfgang Roeder, Richard Scherhag et al 1970 174 p In GERMAN, ENGLISH summary
(QR-1-Pt-1) Avail: NTIS

Daily height and temperature analyses of constant pressure levels for three months for the whole of the Northern Hemisphere, based on rawinsonde and rocketsonde data, and performed with the aid of a hydrostatic buildup method are presented. The corresponding monthly mean maps, and their variations and deviations are included as well as the mean gridpoint data, calculated from daily values. The stratospheric circulation of polar, middle, and tropical latitudes is also described for the period under consideration.
Author

N71-15958+ Freie Univ., Berlin (West Germany). Inst. for Meteorology and Geophysics.
METEOROLOGICAL DATA. VOLUME 117, NO. 1: DAILY ALTITUDE MAPS OF THE 30 mb LEVEL AS WELL AS MONTHLY MEAN MAPS FOR 1970, PART 1 Quarterly Report [METEOROLOGISCHE ABHANDLUNGEN. BAND 117, HEFT 1: TAEGLICHE HOEHENKARTEN DER 30-mb-FLAECHE SOWIE MONTALICHE MITTELKARTEN FUER DASJAHR 1970. TEIL 1, 1 VIERTELJAHR]
Krista Hollan, Barbara Kriester, Karin Labitzke, Renate Lenschow, Karin Petzoldt et al 1970 119 p In GERMAN; ENGLISH summary
(QR-1-Pt-1) Avail: NTIS

Daily height and temperature analyses of constant pressure levels for three months for the whole of the Northern Hemisphere, based on rawinsonde and rocketsonde data, and performed with the aid of a hydrostatic buildup method are presented. The corresponding monthly mean maps, and their variations and deviations are included as well as the mean gridpoint data, calculated from daily values. The stratospheric circulation of polar, middle, and tropical latitudes is also described for the period under consideration.
Author

N71-15959+ Freie Univ., Berlin (West Germany).
METEOROLOGICAL DATA. VOLUME 112, NO. 7: RESULTS OF THE SYNOPTIC SERVICE IN 1970. DAILY WEATHER CHARTS (GROUND, 500 mb, 300 mb) AND BRIEF SCIENTIFIC ESSAYS. JULY [METEOROLOGISCHE ABHANDLUNGEN. BAND 112, HEFT 7: ERGEBENISSE DES SYNOPTISCHEN

DIENSTES IM JAHRE 1970. TAEGLICHE WETTERKARTEN (BODEN, 500 MB, 300 MB) UND ISKLEINERE WISSENSCHAFTLICHE AUFSAETZE]

Manfred Geb, Leopold Klauser, and Richard Scherhag 1970 196 p refs In GERMAN

Avail: NTIS

The reports include temperature variations in the Alps, weather forecast for central Europe for July 1970, the increase in sunshine over Husum station, atmospheric pressure, and climatological and meteorological parameters in the Berlin area during July 1970. Daily radiosonde data, with corrections and additions, are also given. Transl. by R.B.

N71-15979# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CHARACTERISTICS OF TURBULENCE IN THE SURFACE BOUNDARY LAYER IN A MOUNTAIN VALLEY IN WINTER

V. P. Kurbatkin Sep. 1970 13 p refs Transl. into ENGLISH from Tr. Srednеaz. Nauchno-Issled. Gidrometeorol. Inst. (USSR), v. 56, no. 41, 1968 p 51–56

(AD-714754; FTD-HT-23-448-70) Avail: NTIS CSCL 4/2

Results are presented of studies carried out in the Pskem river valley (Tien-Shan mountains) in connection with weather modification tests made with ground-based aerosol generators. These studies required quantitative determinations of turbulence characteristics, especially of the coefficient of turbulence in this mountain valley during the winter. Gradient observations were made daily from 20 November 1965 to 10 March 1966 at 0700, 1000, 1300, 1600, 1900 and 2000 hr of the air temperature and winds at h equals 0.2, 0.5, 1.0, and 2.0 meters. Soil temperatures were measured during the mid-winter period. The data were analyzed in accordance with the Obukhov-Monin equations and with the Monin-Kazanskiy nomogram, i.e., assuming that the roughness and stability parameters given adequately define turbulence. Ground covers (vegetation, snow), degree of cloudiness (clear or overcast), the mean monthly variations in the stability parameter, given mean values m/sec, and the maximum and minimum values of the turbulence coefficient are presented in tables. Author (GRA)

N71-15982# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INTERNATIONAL SYMPOSIUM ON DYNAMICS OF LARGE-SCALE ATMOSPHERIC PROCESSES

G. I. Marchuk et al 4 Sep. 1970 50 p refs Transl. into ENGLISH from the Russian Symp. held at Moscow, 1965

(AD-714749; FTD-MT-24-136-70) Avail: NTIS CSCL 4/1

Contents: Numerical methods for the solution of problems of dynamic meteorology; The numerical solution of problems of weather forecasting; Study of the factors conditioning the nonstationary nature of overall atmospheric circulation. GRA

N71-16015# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EQUIPMENT COMPLEX FOR THE AUTOMATIC RECEIVING AND PROCESSING OF METEOROLOGICAL RADAR DATA

V. A. Petrushevskii et al 3 Sep. 1970 34 p refs Transl. into ENGLISH from the Russian

(AD-714764; FTD-MT-24-176-70) Avail: NTIS CSCL 4/2

Equipment is being developed for complete automation of the processing of meteorologic radar data at a time interval during which the data retains its significance. Such a system will be developed on the basis of an MRL-1 meteorologic radar station and a special digital computer. The maximal working cycle of the system will not exceed 30 min. Author (GRA)

N71-16045# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

A STATIONARY NONLINEAR MODEL OF GENERAL ATMOSPHERIC CIRCULATION

V. A. Efimov 1 Sep. 1970 18 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 208, 1967 p 132–139

(AD-714763; FTD-MT-24-151-70) Avail: NTIS CSCL 4/2

A system of equations of atmospheric hydrothermodynamics for the entire earth system is developed. The system is complicated by the consideration of radiative heat fluxes, and by phase transitions of atmospheric water which must be included both in the equation, and in the boundary conditions. To simplify the solution and to save computer time, the heat flux from atmospheric phase transitions is disregarded; the radiative heat flux over the entire volume of the atmosphere is preassigned. In this manner, the system of equations is reduced to nonlinear differential equations of hydrothermodynamics, and to a three-dimensional problem. The temperature is expressed through the geopotential, using the equation of statics written in an isobaric system of coordinates; the equation of atmospheric hydrothermodynamics is initially written in an isobaric-spherical system of coordinates. A given obtained solution is a system of n nonlinear algebraic equations with respect to unknown given coefficients; it can be used to develop a stationary picture of the circulation with a preassigned heat flux. Author (GRA)

N71-16109# Air Force Systems Command, Wright-Patterson AFB, Ohio.

SOME CHARACTERISTICS OF THE DISTRIBUTION OF CLOUD COVER ON DAYS WITH AND WITHOUT PRECIPITATION

A. N. Lebedev 1 Sep. 1970 27 p Transl. into ENGLISH from Tr. Gl. Geofizicheskaya Observ. (Leningrad), no. 163, 1964 p 56–75

(AD-714431; FTD-MT-24-195-70) Avail: NTIS CSCL 4/2

Observational data for the period 1935-1955 have been used to compute the mean characteristics of the cloud cover on days with and without precipitation in layers of given gradations of heights and the probability of these gradations. It was found that the geographical and seasonal distribution of these data differ appreciably on days with and without precipitation. The average cloud cover when the lower cloud boundary is 100-1, 000 meters is spring and autumn and 300-600 meters in summer on days with precipitation is usually appreciably greater than on days without precipitation. In individual months in some regions, the average cloud cover is 1.5-2.0 time greater than the average cloud cover for rainless days. It is characteristic that clouds above 1,500 meters are largely observed only on days without precipitation. Gradations of heights of the lower cloud boundary of 0-50 and 50-100 meters are observed on both rainy and rainless days. Author (GRA)

N71-16199# Army Foreign Science and Technology Center, Washington, D.C.

ESTABLISHMENT OF NORMS FOR DRY ICE DISBURSEMENT IN SEEDING INTRAMASS STRATUS CLOUDS AND FOG [O NORMIROVANII RASKHODA TVERDOI UGLEKISLOTY PRI VOZDEISTVII NA VNUTRIMASSOVYE SLOISTYE OBLAKA I TUMANY]

I. P. Polovina 15 Apr. 1970 18 p refs Transl. into ENGLISH from Tr. Ukr. Nauchn. Issled. Gidrometeorol. Inst. (Leningrad), no. 61, 1966 p 41-49

(AD-713980; FSTC-HT-23-668-70) Avail: NTIS CSCL 4/2

The test results on the effect of dry ice for dispersal of supercooled stratus and stratocumulus clouds are reported. Existing ideas on the dependence of the norms for disbursement of CO2 on cloud capacity were made more precise by experimental data. The effect of dry ice at temperatures higher than −4 degrees, high wind velocity and seeding at various levels above upper cloud boundaries is discussed. Author (GRA)

N71-16281* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

WIND VELOCITY PROBING DEVICE AND METHOD Patent

Robert F. Stengel, inventor (to NASA) Issued 21 Apr. 1970 (Filed 24 Jan. 1966) 8 p Cl. 73-189; Int. Cl. G01w1/08

(NASA-Case-XLA-02081; US-Patent-3,507,150; US-Patent-Appl-SN-522795) Avail: US Patent Office CSCL 04B

Apparatus for probing an altitude interval and obtaining wind velocity profiles over the interval is described. A tubular body is released which has a light ballast weight, place forward for aerodynamic stability, and four large delta wings in cruciform arrangement. The wings are covered with aluminized Mylar film to provide a lifting and radar-reflective surface for tracking during free fall. Lateral deviations of the body from the vertical are measured, indicating the wind velocities at the various altitudes. N.E.N.

N71-16282# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PHYSICO-STATISTICAL METHOD FOR LONG-RANGE WEATHER FORECASTING

M. I. Yudin 2 Sep. 1970 35 p refs Transl. into ENGLISH of the book "Fiziko-Statisticheskiy Metod Dolgostrochnykh Prognozov Pogody" Leningrad, Gidrometeorologicheskoye Izd-Vo 1968 p 1-28

(AD-713881; FTD-MT-24-137-70) Avail: NTIS CSCL 4/2

The book deals with the principles of the physical-statistical method of long-range weather forecasting and methods of statistically analyzing information, which have been used in recent years at the Main Geographical Observatory im. A. I. Voyeyikov. Representative and generalized features and characteristics of weather to come are also discussed. The booklet has 10 figures, 2 tables, and a bibliography of 24 titles. Author (GRA)

N71-16286# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SOME PROBLEMS IN THE OBJECTIVE FIELD ANALYSIS OF THE WIND

M. O. Krichak 5 Oct. 1970 21 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 228, 1968 p 87-97

(AD-714432; FTD-MT-24-145-70) Avail: NTIS CSCL 4/2

An evaluation is made of a proposal presented by the author in an earlier paper, according to which optimum interpolations might be made of wind vectors at network grid intersections using aerological station soundings. The empirical evaluation of the accuracy of this proposed scheme involved experimental interpolation for the station data; these results were then compared with the measured data for the u and v fields at three levels (850, 500, and 300 mb) for nine situations. Data from about 200 stations were used in the analyses; the mean square errors of u and v were calculated and compared for each of these levels, i.e., velocities of about 5, 7 and 11 m/sec. The interpolation analysis demonstrated close agreement between the theoretical and empirical data and, therefore, that the theoretically derived values are good indicators for a true accuracy analysis. Author (GRA)

N71-16319# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.

A TECHNIQUE FOR DETERMINING VERTICAL GRADIENTS OF WIND AND TEMPERATURE IN THE SURFACE BOUNDARY LAYER

Frank V. Hansen Ft. Monmouth, N. J. ECOM Aug. 1970 28 p refs

(AD-714366; ECOM-5324) Avail: NTIS CSCL 4/2

For many scientific and engineering applications it is desirable to have estimates of wind and temperature profiles and associated flow parameters. Based upon the premise that similarity theory represents mean flow conditions in the surface boundary layer, a procedure is outlined whereby paired wind and temperature measurements together with the conjugate laws of the profiles can be used for determining actual gradients and turbulent characteristics. Author (GRA)

N71-16320# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PHYSICAL-STATISTICAL METHOD OF LONG-RANGE WEATHER FORECASTING

N. I. Zverev 7 Sep. 1970 26 p refs Transl. into ENGLISH from Tr. Gidrometeorol. Nauchn. Issled. Tsentr SSSR, no. 12, 1968 p 45-58

(AD-714423; FTD-MT-24-169-70) Avail: NTIS CSCL 4/2

The author has analyzed the principal sources and types of errors in the hydrodynamic method of forecasting the mean-monthly air temperature anomaly. These methods have been in use for several years at the Hydrometeorological Center of the USSR. Linearization of the thermo and hydrodynamic equations is shown not to be responsible for the numerical errors encountered in this method, which is demonstrated to correctly reflect the mechanism of atmospheric processes and to be capable of providing long-range numerical predictions suitable for practical use. Attention is called, in connection with this method, to the importance of initial aerological information covering the territory of the northern hemisphere and to the general inadequacy of these data. It is argued that since the regions of poor meteorological and aerological coverage remain constant, they should give rise to systematic errors in the numerical forecasting of the mean-monthly air temperature anomaly. Author (GRA)

N71-16338# Freie Univ., Berlin (West Germany).

METEOROLOGICAL DATA. VOLUME 107, NO. 1: DAILY AND MONTHLY NORTHERN HEMISPHERE 30-MILLIBAR-SYNOPTIC WEATHER MAPS OF THE YEAR 1969. PART 1: JANUARY-MARCH Quarterly Technical Status Report

Dietrich Just, Barbara Kriester, Karin Labitzke, Renate Lanschow, Karin Petzoldt et al 1970 113 p

(Contract DAJA37-70-C-2330)

(AD-714371; QTSR-1-Pt-1) Avail: NTIS CSCL 4/2

The present volume continues the series of stratospheric weather maps published since 1957 in the Meteorologische Abhandlungen of the Meteorological Institute of the Free University. It contains daily height and temperature analysis of constant pressure levels for three months for the whole of the northern hemisphere, based on rawinsonde and in the upper stratosphere also on rocketsonde data and performed with the aid of a hydrostatic build-up method. The corresponding monthly mean maps, their variations and deviations are included as well as the mean gridpoint data, calculated from daily values. Moreover, the stratospheric circulation of polar, middle, and tropical latitudes is described for the period under consideration. Author (GRA)

N71-16340* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

PASSIVE OPTICAL WIND AND TURBULENCE DETECTION SYSTEM Patent

Fritz R. Krause, inventor (to NASA) Issued 17 Mar. 1970 (Filed 1 Nov. 1967) 5 p Cl. 250-209; Int. Cl. H01j39/12

(NASA-Case-XMF-14032; US-Patent-3,501,641; US-Patent-Appl-SN-679862) Avail: US Patent Office CSCL 04B

A rapidly moving remote detection system is described for monitoring atmospheric conditions over vast and sparsely instrumented areas from a single airplane or satellite. This is

accomplished by passive optical detection,i.e., detecting modulations in light from extended natural radiation backgrounds such as scattered sunlight and thermal emission. The apparatus consists of two telescopes having divergent fields of view. A single detector is mounted in one telescope and a fan array of detectors is mounted in the other telescope. A time delay is introduced into the signal of the single detector, the first to view an area, and this generates an effect equivalent to having one undelayed telescope trailing in the same orbit. The lines of sight of the delayed and undelayed telescope detectors intersect at a chosen altitude. Light modulations occurring near this intersection exert a common influence on the detector signals. An on board computer performs a digital correlation analysis of the detector signals to extract local information from the detector signals as to atmospheric conditions at the intersection. Official Gazette of the U.S. Patent Office

N71-16425# Michigan Univ., Ann Arbor. Dept. of Mathematics.
TURBULENCE MEASUREMENTS MADE FROM FLIP IN BOMEX Annual Report, 15 Aug. 1969 – 15 Aug. 1970
Donald J. Portman, Kenneth L. Davidson, and Michael A. Walter Aug. 1970 46 p refs
(Contract N00014-67-A-0181-0005)
(AD-713860; Rept-08849-3-P; AR-3) Avail: NTIS CSCL 4/2

Simultaneous measurements of wind velocity components with hot-film anemometers, air temperature fluctuations, and wave heights were made about 200 miles east northeast of Barbados during BOMEX. A total of 54 hours of measurements were made during the last two weeks in May, 1969. Of these, 23 had simultaneous recordings of wind velocity components and temperature fluctuations at two heights. Measurement heights were 2, 3, 6 and 8 meters above mean water level. Three different computer facilities have been employed in processing the data to obtain probability distribution functions, joint probability distribution functions, spectrum functions and cross-spectrum functions for velocity components, temperature fluctuations and wave heights. Examples of the calculation results are given and briefly described. They show specific effects of waves on the velocity components. Author (GRA)

N71-16442# Naval Weather Service, Washington, D.C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS. MEDITERRANEAN MARINE AREAS. VOLUME 1: AREA 1-ROTA, AREA 2-TANGIER, AREA 3-MALAGA
Oct. 1970 483 p refs
(AD-713992) Avail: NTIS CSCL 4/2

The data contained in these tables were obtained from tape data Family 11 (TDF-11), Marine Surface observations. TDF-11 was primarily funded by the Naval Weather Service Command and selected by NWSED Asheville as the most comprehensive collection of marine surface observations from which to develop a series of coastal marine summaries. The areas discussed includes Rota, Tangier, and Malaya. Author (GRA)

N71-16443# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MAIN GEOPHYSICAL OBSERVATORY TRANSACTIONS
G. D. Kudashkin et al 4 Sep. 1970 58 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 197, 1968 p 3–18, 105–124
(AD-714429; FTD-MT-24-171-70) Avail: NTIS CSCL 4/2

Contents: Selection and utilization of analogs for refining numerical weather forecasts; and Four-level nonadiabatic model for forecasting of meteorological elements for the hemisphere. GRA

N71-16444# Weather Wing (1st), San Francisco, Calif. 96553
DECEMBER CLIMATE OF SOUTHEAST ASIA Final Report
Oct. 1970 67 p
(AD-714070; WWSS-105-11/2) Avail: NTIS CSCL 4/2

The report deals with the climate of North Vietnam, Republic of Vietnam, Laos, Cambodia and Thailand for December. Essentially based on previously available data, however, precipitation analyses, ceiling/visibility and upper air flow are new. Contains brief notes on the climate of Southeast Asia and the geographical features of the Republic of Vietnam, North Vietnam, Cambodia, Laos, and Thailand. Discusses the precipitation, thunderstorms, cloudiness, visibility and obstructions to vision, combined ceiling/visibility, temperature, relative humidity, surface and upper winds, miscellaneous phenomena and sea operations. Contains a station locator and topography map. Isoline analyses (map scale 1:9,000,000) are given for precipitation days, means, maximum, and minimum precipitation, days with thunderstorm. Also included are charts of mean position of polar front and ICZ (1:17,000,000) typhoon tracks (1:10,000,000), sea surface currents, temperatures, frequency of breakers, sea swell (1:10,000,000). Monthly sunrise, sunset, morning and evening twilight data are presented for Saigon with method for adapting to other stations. Author (GRA)

N71-16507# Army Electronics Command, Fort Monmouth, N.J. Atmospheric Sciences Lab.
WEATHER RADAR INVESTIGATIONS OF THE BOMEX
Michael D. Hudlow Sep. 1970 114 p refs
(AD-714191; ECOM-3329) Avail: NTIS CSCL 4/2

The Atmospheric Sciences Laboratory (ASL), Fort Monmouth, New Jersey, participated in the Barbados Oceanographic and Meteorological Experiment (BOMEX) from May through July 1969. A radar team, using an AN/MPS-34 weather radar from ASL, provided 24-hour radar surveillance of all echo areas within vicinity of the BOMEX array. The primary objective was to obtain measurements of storm characteristics, including reflectivity distributions, for the duration of BOMEX. Radar scope photography was employed. Time-lapse photographs with gain-stepping were taken with an automatic 35mm camera. In addition, a minimum of one polaroid photo every three hours was collected for real-time documentation. Elevation sequences were taken twice daily. A description of the experiment, including all pertinent information and calibrations necessary for interpretation of the films, is presented. Some preliminary analyses of the radar pictures, primarily the polaroid photos, have been made. Storm characteristics such as size, height, and intensity, are illustrated. The temporal and spatial variations in echo statistics are considered. Recommendations concerning further processing and analyses of the radar film and other data pertinent to deriving precipitation inputs for a line integral experiment, are offered. Author (GRA)

N71-16512# Joint Publications Research Service, Washington, D.C.
METEOROLOGY
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 243 30 Dec. 1970 p 5–14 (See N71-16510 06-13)
Avail: NTIS

News items and research abstracts on the following topics are summarized: actinometry and ozone, seasonal planetary pressure variations in the upper atmosphere, and passive contaminant propagation in a turbulent medium. Outlines are given for books on; atmosphere and hydrosphere interaction in the Arctic, small scale interactions between the ocean and the atmosphere, the history of the Ukrainian Hydrometeorological Service, and meteorological factors affecting supersonic flight. E.C.

N71-16519# Chicago Univ., Ill. Lab. for Atmospheric Probing.
DOPPLER RADAR OBSERVATION OF DROP-SIZE DISTRIBUTION IN A THUNDERSTORM
R. S. Sekhon and R. C. Srivastava Oct. 1970 40 p refs

Submitted for publication. Prepared in cooperation with IIT Res. Inst., Chicago, Ill.
(Grants NSF GA-919; NSF GA-10639)
(TR-18) Avail: Issuing Activity

Data obtained in a thunderstorm with a vertically pointing Doppler radar are analyzed to find the size distribution of raindrops at heights below the freezing level. Mathematical equations and models are presented to represent the drop size at all levels. The radar reflectivity factor, the relationship of the mean Doppler velocity, and the distribution parameters are considered. Author

N71-16578# Naval Weather Service, Washington, D.C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS. MEDITERRANEAN MARINE AREAS. VOLUME 2: AREA 4-ORAN, AREA 5-CARTAGENA, AREA 6-BARCELONA, AREA 7-MARSEILLE
Oct. 1970 671 p
(AD-714288) Avail: NTIS CSCL 4/2

The data contained in these tables were obtained from tape data Family 11 (TDF-11), Marine Surface observations. TDF-11 was primarily funded by the Naval Weather Service Command and selected by NWSED Asheville as the most comprehensive collection of marine surface observations from which to develop a series of coastal marine summaries. The areas discussed includes Oran, Cartagena, Barcelona, and Marseille. Author (GRA)

N71-16667 International Geophysical Year World Data Center A, Washington, D.C. Meteorology.
HIGH ALTITUDE METEOROLOGICAL DATA, VOLUME 6, NO. 5, MAY 1969 Data Report
Asheville, N.C. NOAA, Natl. Climatic Center 1970 185 p
Avail: SOD $3.00

Wind and temperature measurements from all available meteorological sounding rocket firings are presented, along with computed values for pressure, density, and speed of sound. Local radiosonde observations nearest the time of firing are included. Author

N71-16714# National Weather Service, Silver Spring, Md. Weather Analysis and Prediction Div.
WEATHER BUREAU APRIL 1969–MARCH 1970 VERIFICATION REPORT WITH SPECIAL EMPHASIS ON PAST PERFORMANCE SCORES WITHIN ECHELONS
Robert G. Derouin and Geraldine F. Cobb Jan. 1971 75 p refs
(NOAA-TM-NWS-FCST-16) Avail: NTIS

Performance scores for April 1969 through March 1970 of the guidance from the National Meteorological Center (NMC), state forecasts from the Weather Bureau Forecast Offices (WBFOs), and local forecasts from the Weather Bureau Offices are presented. Winter forecasts for 1969-70 were poorer than 1968-69, mainly for precipitation, and it is likely that an operational change in the NMC PE model which gave output generally too dry was partly responsible. Scores within each echelon are listed and comparisons made in relation to the national level of like scores giving each station an indication of its performance. Of the seven WBFOs established within the past two years, three performed as well or better than other WBFOs relative to their NMC guidance. Author

N71-16715# Weather Wing (1st), San Francisco, Calif. 96553
NOVEMBER CLIMATE OF SOUTHEAST ASIA Final Report
Oct. 1970 65 p Supersedes Rept-1WWSS-105 11/11, Aug. 1966
(AD-714566; Rept-1WWSS-105-11/11) Avail: NTIS CSCL 4/2

The report deals with the climate of North Vietnam, Republic of Vietnam, Laos, Cambodia and Thailand for November. Essentially based on previously available data, however, precipitation analyses, ceiling/visibility and upper air flow are new. Contains brief notes on the climate of Southeast Asia and the geographical features of the Republic of Vietnam, North Vietnam, Cambodia, Laos, and Thailand. Discusses the precipitation, thunderstorms, cloudiness, visibility and obstructions to vision, combined ceiling/visibility, temperature, relative humidity, surface and upper winds miscellaneous phenomena and sea operations. Contains a station locator and topography map. Isoline analyses (map scale 1:9,000,000) are given for precipitation days, mean, maximum, and minimum precipitation, days with thunderstorm, mean cloudiness, percent frequency of ceiling/visibility, daily max and min temperatures and mean relative humidity. Also included are charts of mean position of polar front and ICZ (1:17,000,000) typhoon tracks (1:10,000,000), sea surface currents, temperatures, frequency of breakers, sea swell (1:10,000,000). Monthly sunrise, sunset, morning and evening twilight data are presented for Saigon with method for adapting to other stations. Author (GRA)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N71-15951# Joint Publications Research Service, Washington, D.C.
GYROSCOPIC AND NAVIGATIONAL INSTRUMENTS
22 Dec. 1970 19 p refs Transl. into ENGLISH from Izv. Vysshikh. Uchebn. Zavedenii, Priborostr. (Leningrad), v. 13, no. 9, 1970 p 65–78
(JPRS-52046) Avail: NTIS

CONTENTS:

1. STABILITY OF STEADY MOVEMENTS OF A GYROSCOPE WITH ELASTIC ROTOR BEARINGS IN A NEWTONIAN CENTRAL FORCE FIELD V. I. Popov p 1–5 refs (See N71-15952 06-21)
2. FLOATING INTEGRATING GYROSCOPE WITH FEEDBACK R. A. Abramov p 6–9 ref (See N71-15953 06-21)
3. RELATION BETWEEN THE PRECESSION AND NUTATION OF A GYROSCOPE V. V. Alisina p 10–14 refs (See N71-15954 06-21)
4. INDIRECT STABILIZATION OF MAGNETOMETERS ON A MOVING OBJECT S. F. Farmakovskiy et al p 15–18 ref (See N71-15955 06-21)

N71-15952# Joint Publications Research Service, Washington, D.C.
STABILITY OF STEADY MOVEMENTS OF A GYROSCOPE WITH ELASTIC ROTOR BEARINGS IN A NEWTONIAN CENTRAL FORCE FIELD
V. I. Popov *In its* Gyroscopic and Navigational Instruments 22 Dec. 1970 p 1–5 refs (See N71-15951 06-21)
Avail: NTIS

The problem of stability of the steady movements of a rigid shaft with a disc on elastic bearings is solved by the Routh procedure. This procedure with modifications is used to study the stability of a gyroscope with elastic rotor bearings. Author

N71-15953# Joint Publications Research Service, Washington, D.C.
FLOATING INTEGRATING GYROSCOPE WITH FEEDBACK
R. A. Abramov *In its* Gyroscopic and Navigational Instruments 22 Dec. 1970 p 6–9 ref (See N71-15951 06-21)
Avail: NTIS

The possibility of improving the precision of a gyrostabilizer made of two-stage floating integrating gyroscopes having feedback with respect to the reactive moment of the gyrounit is demonstrated. Author

N71-15954# Joint Publications Research Service, Washington, D.C.

RELATION BETWEEN THE PRECESSION AND NUTATION OF A GYROSCOPE

V. V. Alisina *In its* Gyroscopic and Navigational Instruments 22 Dec. 1970 p 10-14 refs (See N71-15951 06-21)

Avail: NTIS

Methods of discovering the numerical relations between the nutation and precession displacements of a free Lagrange gyroscope are investigated. Using the known principles of the classical theory of a free Lagrange gyroscope, the expression for the displacement of the gyroscope is obtained with respect to the angle of precession during the nutation displacement between the boundary values of the nutation angles. Author

N71-15955# Joint Publications Research Service, Washington, D.C.

INDIRECT STABILIZATION OF MAGNETOMETERS ON A MOVING OBJECT

S. F. Farmakovskiy et al *In its* Gyroscopic and Navigational Instruments 22 Dec. 1970 p 15-18 ref (See N71-15951 06-21)

Avail: NTIS

Elimination of errors occurring during mechanical stabilization of magnetometers is investigated with respect to indirect stabilization by installing the magnetometers directly on the hull of the object. Using the indicated method, the modulus and the angles which fully determine the vector of the earth's magnetic field in the geographic coordinate system are obtained directly by measurement on the object. Author

N71-16198# IIT Research Inst., Annapolis, Md.

FUTURE INSTRUMENT CANDING SYSTEM CHANNEL REQUIREMENTS

B. H. Metzger Oct. 1970 32 p refs

(Contract F19628-70-C-0291)

(AD-714111; ESD-TR-70-362) Avail: NTIS CSCL 17/7

As an aid to spectrum planning, estimates of the minimum channel requirements for the Instrument Landing System localizer are obtained for the 1970-1975 time period. Several alternatives in antenna systems, service volumes, assignment criteria and operational procedures are considered with respect to their possible impact on channel requirements. Author (GRA)

N71-16204# Southern Methodist Univ., Dallas, Tex. Information and Control Sciences Center.

AUTOMATIC NAVIGATION Interim Scientific Report, 1 Sep. 1969 -31 Aug. 1970

Andrew P. Sage 31 Aug. 1970 79 p refs

(Contract F44620-68-3-0023)

(AD-714699; AFOSR-70-2589TR) Avail: NTIS CSCL 12/1

The interim scientific report summarizes activities in Optimization and Estimation Theory with applications to communications and control and with special emphasis on Automatic Navigation under Air Force Office of Scientific Research Contract F44620-68-C-0023 during the period September 1, 1969 through August 31, 1970. Author (GRA)

N71-16205# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst.

SUBOPTIMIZATION OF A KALMAN FILTER WITH DELAYED-STATES AS OBSERVABLES

Terry B. Cline and C. James Triska Oct. 1970 84 p refs

(Contract N00014-68-A-0162)

(AD-714501; ISU-ERI-AMES-77000) Avail: NTIS CSCL 12/1

The computational requirements of the Kalman filter may become excessive when the measurement model includes a connection with both the present state and a previous state. Three aspects of this problem are studied. A performance analysis is presented and a performance index is defined as an aid in evaluating the performance of two classes of suboptimal filters which may be used to solve this problem. The two classes are suboptimality due to modeling variations and due to alternate gain algorithms. A suboptimal filter is derived which belongs to the second class. The simulation of a proposed integrated inertial/doppler-satellite navigation system is performed to study the performance of filters belonging to both of the above classes. Author (GRA)

N71-16206# Naval Intelligence Command, Alexandria, Va. Translation Div.

ACCURACY AND RANGE OF TELECONTROL SYSTEMS [TOCHNOST I DALNOST DEISTVIYA SISTEM TELEUPRAVLENIYA]

L. S. Gutkin et al 3 Nov. 1970 44 p Transl. into ENGLISH from the Russian

(AD-714437; NIC-TRANS-3134) Avail: NTIS CSCL 17/7

In another document it was pointed out first that the second type of telecontrol has much in common with homing, and, second, that it is used much more infrequently than homing, or the first type of telecontrol. Therefore, in the interests of brevity, this chapter will consider only the first type of telecontrol (TU-1). There is a much closer association between system range and system accuracy in the first type of telecontrol than in the case of homing. In the case of TU-1, the range of a control system is determined, practically speaking, by the range of the target monitoring channel. The maximum range of the target monitoring channel is limited by the need to provide the required values for the following indices of control system quality: dependability of locking on to the target (lock-on probability), dependability of holding the target (slight probability of interruption in target tracking), and accuracy in guiding the missile to the target. GRA

N71-16294# Air Force Systems Command, Wright-Patterson AFB, Ohio. Medical Research Lab.

COMPARISON OF A MOVING MAP DISPLAY AND TWO GRAPHICS WITH HAND-HELD MAPS Final Report

Don F. McKechnie May 1970 29 p refs

(AD-714061; AMRL-TR-69-110) Avail: NTIS CSCL 17/7

A flight test program incorporating a Bendix Moving Map Display in a Cessna 02A aircraft was accomplished to take a preliminary look at the use of the display in a simple flying task to determine if further exploration in more complex tasks such as forward air controller missions would be warranted. Twelve 02A pilots flew three prescribed flight paths using one of these three different navigation aids on each path: hand-held 1:50,000 map; 1:50,000 map strip in the display; and 1:50,000 photo strip in the display. The opinions of the pilots and a radar plot of the flights were obtained for evaluation. Author (GRA)

N71-16295# Naval Research Lab., Washington, D.C.

SIMULATION MODEL FOR THE AADC

William R. Smith Sep. 1970 18 p

(AD-714140; NRL-MR-2172) Avail: NTIS CSCL 17/7

A Navy program to develop a flexible airborne computer which will be compatible with changing avionics mission requirements has led to an effort to implement a computer simulation of the proposed avionics system under representative program workloads.

Realistic modeling of system software and hardware requires a simulation which reveals the effect of interaction between segments of program and computer resources. The SIMSCRIPT programming language is being used to implement an event oriented simulation of the avionics multiprocessor and its attendant workload. Examination of the utilization of system resources in the model will aid in determining the optimum computer configuration from among choices under consideration. Author (GRA)

N71-16492# Systems Development Corp., Huntsville, Ala.
STUDY OF THE USAF TACTICAL AIR CONTROL SYSTEM (TACS)
23 Oct. 1970 81 p refs
(Contract DAAH01-70-C-0883)
(AD-714292; TM-L-HU-035/000/01) Avail: NTIS CSCL 17/7

The information search study provides a description of the Tactical Air Control System (TACS) and the improvement program 407L. TACS is comprised of four major subsystems: Aircraft Control and Warning, Tactical Air Support, Air Traffic Control and Command Communications. Operating elements and major equipment components of the four subsystems are described with particular emphasis placed on the CRC/CRP AN/TSQ-91 of the Aircraft Control and Warning subsystem. Author (GRA)

N71-16518*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SKYLAB ATTITUDE AND POINTING CONTROL SYSTEM
W. B. Chubb and S. M. Seltzer Washington Feb. 1971 17 p refs
(NASA-TN-D-6068; M-211) Avail: NTIS CSCL 17G

NASA's Marshall Space Flight Center is developing an earth-orbiting manned space station called Skylab. The purpose of Skylab is to perform scientific experiments in solar astronomy and earth resources and to study biophysical and physical properties in a zero gravity environment. The attitude and pointing control system requirements are dictated by onboard experiments. These requirements and the resulting attitude and pointing control system are presented. Author

N71-16556# Joint Publications Research Service, Washington, D.C.
DESIGN AND OPERATION OF AMUR-2 GYROCOMPASS
A. A. Bekman 14 Jan. 1971 12 p Transl. into ENGLISH from the book 'Ustroystvoi i Ekspluatatsiya Shturmanskikh Priborov' Moscow, 1970 p 34–44
(JPRS-52174) Avail: NTIS

The Amur-2 gyrocompass is a miniaturized dual-gyroscope compass with liquid suspension of the sensing element. It is non-aperiodic because it lacks a device for controlling the period of the nondamping vibrations of the gyrosphere and at a change in the latitude of the site, it is stabilized at a level of T-84.4 minutes. Author

N71-16594*# Dynamics Research Corp., Wilmington, Mass. Systems Div.
INITIAL SPECIFICATIONS FOR VAN AND AIRCRAFT TESTING OF THE SD-53 STRAPDOWN SYSTEMS
William H. Fincke and Donald O. Benson, Jr. 5 Nov. 1970 142 p refs
(Contract NAS8-25971)
(NASA-CR-103016; E-2266U) Avail: NTIS CSCL 17G

Provided is a basis for field evaluation of the SD-53 Strapdown Inertial System both in a van and in an aircraft. The Inertial Sensing Unit (ISU) of the system contains three single Axis Platform (SAP) gyros and three Pendulous Integrating Gyro Accelerometers (PIGAs). For both the van and flight test programs, a Minneapolis Honeywell 516 computer will be used to process the inertial sensor outputs. Author

N71-16672*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ADVANCED STUDIES
In its Space Programs Sum. No. 37-65, Vol. 3, Aug.–Sep. 1970 31 Oct. 1970 p 1–2 refs (See N71-16671 08-30)
Copyright. Avail: NTIS CSCL 17G

A landmark navigation position updating technique is described for lunar roving vehicle missions. The method is based on computerization of the process for the purpose of minimizing the updating time and improving the accuracy of the position estimate. The test plan for the lunar navigation computer program is discussed. R.B.

N71-16679*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GUIDANCE AND CONTROL ANALYSIS AND INTEGRATION
In its Space Programs Sum. No. 37-65, Vol. 3, Aug.–Sep. 1970 31 Oct. 1970 p 96–117 refs (See N71-16671 08-30)
Copyright. Avail: NTIS CSCL 17G

Research in guidance and control analysis and integration is considered, with emphasis on subroutines to compute planet and satellite photometric magnitudes, in-flight calibration of a TV instrument for optical spacecraft navigation, prebreakdown characteristics in a cesium thermionic discharge, inertial and gyrocompass/odometer navigators for roving vehicles, approach guidance subsystem development, structural damage in lithium-doped silicon solar cells from neutron irradiation, and investigation of radiation damage in lithium-diffused silicon solar cells by infrared techniques. R.B.

N71-16680*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACECRAFT CONTROL
In its Space Programs Sum. No. 37-65, Vol. 3, Aug.–Sep. 1970 31 Oct. 1970 p 118–121 (See N71-16671 08-30)
Copyright. Avail: NTIS CSCL 17G

An attitude control single-axis simulator was constructed to provide a breadboard hardware verification of the Thermoelectric Outer-Planet Spacecraft baseline attitude control system. The baseline system utilizes momentum wheels to counteract disturbance torques and provide a commanded turn capability, and a hydrazine gas system to unload the momentum wheels and counteract potentially large disturbance torques. A true position encoder for the simulator is also described. Author

N71-16733*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ORBIT SELECTION CONSIDERATIONS FOR EARTH RESOURCES OBSERVATIONS
Byron L. Swenson Washington Feb. 1971 23 p refs
(NASA-TM-X-2158) Avail: NTIS CSCL 17G

The orbital mechanics problem was examined to determine if various observational requirements can be satisfied and whether a number of different types of observations can be made from a single satellite. Parametric material is presented for determining the extent to which the observational constraints must be relaxed either to perform a single observation or to make several observations compatible. It was determined that high resolution coverage of broad surface areas (i.e., areas of the order of 2000 km and greater in width) was possible within solar angle constraints but that the rapid repetition of such observations (e.g., within less than a month) was not possible with a single satellite. If rapid repetition of observations is required, either low resolution observations must be made, much smaller surface areas must be considered, or multiple satellites must be used. Author

N71-16822*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FIELD TESTS USING DEAD RECKONING AND MONOPTIC

VIDEO FOR REMOTE LUNAR SURFACE NAVIGATION
William C. Mastin and Peter H. Broussard, Jr. 18 Jan. 1971 49 p ref
(NASA-TM-X-64567) Avail: NTIS CSCL 17G

Field tests of simulated remote lunar navigation are described. The navigation system consisted of a dead reckoning unit and a monoptic television unit. The traverses simulated lunar sorties partly in terrain but principally in that the navigators had no more advantages than would be had in an actual sortie. The tests demonstrated not only the feasibility of such a system for long-range lunar navigation but also the ease of implementation and use. Author

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N71-15714# Atomic Energy Establishment, Winfrith (England).
WIMS RESULTS FOR THE LONG-TERM IRRADIATION CHANGES IN THE CALDER HALL REACTORS
C. J. Phillips Oct. 1969 11 p refs
(AEEW-M-934) Avail: AEC Depository Libraries

The available measurements of the isotopic content of irradiated pennies of fuel from Calder Hall have been reanalysed with the WIMS-D code and the results are compared with previous ARGOSY-2A results. Author (NSA)

N71-15715# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
NUMERICAL APPLICATIONS OF A NEW APPROACH TO THE SOLUTION OF THE NEUTRON TRANSPORT EQUATION
E. Cupini, A. de Matteis, F. Premuda, and T. Trombetti 14 Oct. 1969 56 p refs
(RT/FI-(69)45) Avail: AEC Depository Libraries

The results of a feasibility study concerning the numerical applications of a new method for the solution of the stationary neutron transport equation with isotropic scattering are described. The two following problems of reactor physics are treated: (1) finite plane slab with monoenergetic neutrons (calculation of the critical parameter and of the neutron flux distributions in the critical and subcritical cases); (2) finite plane slab with two neutron energy groups, in the critical case. Possible extensions of the method are also discussed. Author (NSA)

N71-15716# Atomic Energy of Canda, Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.
IRRADIATION PERFORMANCE OF ZIRCALOY SHEATHED FUEL ELEMENTS WITH METALLIC OR CERAMIC DISCS BETWEEN UO2 PELLETS
R. D. MacDonald Aug. 1970 53 p refs
(AECL-3606) Avail: AEC Depository Libraries

Zircaloy-clad fuel elements were irradiated with thin disks of refractory metals and oxides between UO2 pellets to study the effect of disks in lowering the bulk average temperature of the fuel. Disk materials included tungsten, molybdenum, rhenium, tantalum, niobium, Al2O3, ThO2, and graphite. The experiment showed that the refractory metal disks between pellets did reduce the grain growth volume in the adjacent UO2 as well as preventing gross redistribution of fuel in elements operating at linear heat outputs >900 W/cm. Disks of refractory metals 1.3 mm thick were all compatible with the fuel while 3.3 mm thick disks of Al2O3 and ThO2 reacted with the UO2. Graphite disks, 1.0 mm thick, were compatible with UO2 at linear heat outputs of 650 W/cm. Disks between pellets did not seem to improve the dimensional stability of the fuel elements. Four of the nine elements in the test defected in-reactor probably because of the low ductility of the Zircaloy sheaths after irradiation. The metal disks apparently provided the localized sheath strain needed to rupture these low ductility sheaths. Author (NSA)

N71-15731# California Univ., Livermore. Lawrence Radiation Lab.
HAZARDS CONTROL Progress Report, Jan. – May 1970
May 1970 20 p refs Sponsored by AEC
(UCRL-50007-70-1; PR-36) Avail: NTIS

Research and surveillance activities of the hazards control department (HCD) during January to May 1970 are reported. Areas of interest include: radiation protection (dosimetry and surveillance activities); industrial hygiene (respiratory cartridge and filter testing); instrumentation development (detectors, monitors, and dosimeters); and education (new course offerings in HCD). Technical notes of interest on research and surveillance activities in the HCD are also included. Publications by staff members during the reporting period are listed. NSA

N71-15732# Power Reactor and Nuclear Fuel Development Corp., Tokai (Japan).
TOKAI WORKS Semiannual Progress Report, Jul. – Dec. 1969
Apr. 1970 108 p refs
(NP-18353; N-831-70-1) Avail: NTIS

Activities directed toward development of mixed U and Pu oxide fuels for advanced fast breeder reactors and advanced thermal reactors are summarized. Work devoted to spent fuel reprocessing technology development and related research work is also reported. NSA

N71-15815*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VACUUM-PACKAGED CESIUM FOR NUCLEAR THERMIONIC DIODES
James F. Morris Washington Jan. 1971 9 p refs
(NASA-TM-X-2152; E-5950) Avail: NTIS CSCL 18J

Out-of-core nuclear thermionics places special demands on the physicochemistry of the converters. The emitters, collectors, and cesium require careful preparation to insure diode performance. For cesium, vacuum packaging allows excellent quality control. Providing this assurance, though, meant developing a new dispensing train and vacuum processing station. These designs and the resulting baked-out, brazed-shut molybdenum capsules of cesium are the subjects of the present report. Author

N71-15825# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorwerkstoffe.
POST-IRRADIATION EXAMINATION OF ATJ GRAPHITE FROM FIRST-CHARGE AVR FUEL ELEMENTS
W. Delle Nov. 1969 14 p refs Transl. into ENGLISH of a German report Sponsored by AEC
(AVR-34) Avail: NTIS

Samples are taken from spherical fuel elements of the first AVR charge for post irradiation examination. Results of the examination for ATJ graphite are presented. Radiation effects on apparent density, open porosity, specific electrical resistance, thermal conductivity, linear thermal expansion, and modulus of elasticity are measured. NSA

N71-15828# Brookhaven National Lab., Upton, N.Y.
EVALUATION OF REACTIVITY METHODS OF NUCLEAR MATERIALS ASSAY
J. R. Beyster Jun. 1970 34 p refs Sponsored by AEC
(BNL-50251) Avail: NTIS

Results of a critical evaluation of the reactivity method indicate that it is not a very promising approach to nuclear materials assay for safeguards purposes. The analysis revealed that the apparatus (a critical or subcritical assembly) is relatively costly, is not transportable, is bulky, requires licensing, criticality safeguards analysis, and very specially trained operating personnel. Operating costs would also be relatively high compared with other active methods. The assay procedures using this device are multistep and time-consuming. The analysis of the data, especially with fluctuating fissionable isotopic content or absorber content, requires great care. The method at present essentially uses thermal neutrons as the probe. The low-energy neutrons have low penetration, and selfshielding is important. Thus, the variety of fuel and sample configurations which can be examined with the method is limited.
Author (NSA)

N71-15874# Westinghouse Electric Corp., Pittsburgh, Pa. PWR Systems Div.
PWR FLECHT INTERIM MATERIALS EVALUATION REPORT
J. H. Berlinghoff, J. F. Mellor, and A. P. Suda Jan. 1970 51 p refs Prepared for Idaho Nuclear Corp.
(WCAP-7444) Avail: NTIS

Results of the metallographic examination of heater rods from the two early Group 3 PWR FLECHT tests conducted in 1969 are summarized. Information on hydrogen content, grain size, and extent of metal-water reaction is included. Also presented are the results of the materials characterization of as-fabricated Group 3 heater rod cladding. The peak temperatures for the two early Group 3 tests were 2100 and 2145 F. It was concluded that the extent of oxidation was slight, with a maximum film thickness of 0.6 mils. The metal-water reaction is nonhomogeneous with variations in oxide film formation increasing with temperature. The hydrogen uptake is relatively small and is a low fraction of available corrosion hydrogen. The general microstructural features (i.e., grain size) are consistent with the time-temperature history of the rods.
Author (NSA)

N71-15876# Argonne National Lab., Ill.
CHEMICAL ENGINEERING DIVISION Annual Report, 1969
Apr. 1970 167 p refs
(Contract W-7405-eng-38)
(ANL-7675) Avail: NTIS

The research and development programs consisted of the following: (1) Pyrochemical processes employing salt-transport separations for the recovery and purification of LMFBR fuel were investigated. Research was also directed to the liquid-metal decladding of LMFBR fuels as an alternative head-end step for aqueous processing. (2) The work on fluid-bed fluoride volatility processing culminated in a conceptual design and evaluation study, which indicated that fluoride volatility methods are technically feasible for the purification and recovery of LMFBR fuels. (3) Work in sodium technology included the study of mechanisms of carbon transport in sodium-steel systems, the establishment of a center for sodium analytical chemistry, and work on the development, evaluation, and improvement of purification devices and on-line monitors for impurities in sodium. (4) Work on the thermodynamics and physical properties of candidate FBR fuels at high temperatures was continued.
Author (NSA)

N71-15914# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Neutronenphysik und Reaktortechnik.
SOME INVESTIGATIONS ON NONDESTRUCTIVE SAFEGUARDS TECHNIQUES
K. Baumung, K. Boehnel, J. Klunker, M. Kuechle, and J. Wolff Jun. 1970 21 p refs Presented at IAEA Symp. on Progr. in Safeguards Tech., Karlsruhe, West Ger., Jul. 1970
(KFK-1208, SM-133/80; CONF-700701-4) Avail: AEC Depository Libraries

Nondestructive assay techniques are studied with the purpose of identifying the optimal method or combination of methods for a practical safeguards system. The methods investigated experimentally included: slowing down time spectrometer; reactivity measurements; delayed neutron measurements; active and passive high resolution gamma-spectroscopy; and coincidence measurements of spontaneous fission neutrons. The slowing time spectrometer was employed to measure the fission rate of fuel pins as a function of neutron energy in the range between 10 eV and 3,000 eV. When calibrated against a standard, this indicates the amount of fissile material. Discrimination between Pu-239 and U-235 is possible if counting rate ratios of appropriate energy ranges are taken. Reactivity measurements can be made with good accuracy in a short time but are normally not tamperproof determinations of the fuel content. However, if three measurements are made for each pin in sufficiently different environments, all important methods of cheating the determination can be excluded.
Author (NSA)

N71-15944# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
SUGGESTED INTERIM STRUCTURAL DESIGN CRITERIA FOR THE FTR PRIMARY PIPING SYSTEM
Marlyn T. Jakub Dec. 1969 50 p refs
(Contract AT(45-1)-1830)
(BNWL-1238) Avail: NTIS

A set of structural design criteria for the primary system piping of the fast test reactor is presented. This piping is to provide a 20-year-life, thin-walled, type 304H SS conduit for 1200 F liquid sodium at pressures of about 300 psi. Future development needs for design with materials at creep temperatures are outlined.
Author (NSA)

N71-15945# Atlantic Richfield Hanford Co., Richland, Wash.
PLANT APPLICATION OF NUCLEAR CRITICALITY PREVENTION PRINCIPLES
G. A. Nicholson 1 Jul. 1970 15 p refs Presented at the 63d Natl. Meeting of the Am. Inst. of Chem. Engr., Chicago
(Contract AT(45-1)-2130)
(ARH-SA-71; CONF-701103-2) Avail: NTIS

A primary concern in the design and operation of a nuclear fuels processing plant is the prevention of an uncontrolled nuclear chain reaction, or nuclear criticality excursion. Effective plant application of criticality prevention principles should commence with process flowsheet design and continue through equipment and facility design and construction. Safe and successful plant operation requires that criticality prevention principles and practices be accorded paramount consideration by all members of the production and support teams.
Author (NSA)

N71-15946# Union Carbide Corp., Oak Ridge, Tenn. Computing Technology Center.
DEVELOPMENT OF TWO-DIMENSIONAL DISCRETE ORDINATES TRANSPORT THEORY FOR RADIATION SHIELDING
F. R. Mynatt (Ph.D. Thesis-Tennessee Univ.), F. J. Muckenthaler, and P. N. Stevens 11 Aug. 1969 220 p refs
(Contract W-7405-eng-26)
(CTC-INF-952) Avail: NTIS

The purpose of this study is to extend the capabilities of the two-dimensional discrete ordinates method in order to provide accurate calculations for deep-penetration radiation transport problems. The basic method is generalized and improved and a

complete technique for application is developed. A clean-geometry experiment was designed and executed, and the results are compared with calculations. The experiment comprises large slab shields exposed to a collimated reactor beam source. Fast neutron dose measurements were also made, including dose profiles at the exit faces of the slabs. Lead, polyethylene, laminated lead and polyethylene, and depleted uranium slabs were included in the study. A large number of calculations were performed and many comparisons are shown. NSA

N71-16192# Idaho Nuclear Corp., Idaho Falls.
BRITTLE BEHAVIOR OF ZIRCALOY IN AN EMERGENCY CORE COOLING ENVIRONMENT
R. H. Meservey and R. Herzel Sep. 1970 30 p refs
(Contract AT(10-1)-1230)
(IN-1389) Avail: NTIS

Scoping tests were conducted to determine the extent and nature of embrittlement of Zircaloy under high temperature conditions. The purpose of these tests was to provide information on Zircaloy embrittlement that could be used in the planning of other experimental programs, particularly those programs in which heat transfer processes under loss-of-coolant accident conditions are being studied through use of Zircaloy-clad electrical heaters as fuel pin simulators. The information acquired was to be used to predict the capability of Zircaloy-clad electrical heaters to withstand loss-of-coolant tests and to assess the effect of the environment during a loss-of-coolant accident (LOCA) on the brittle nature of the Zircalsy fuel cladding. In addition to the degree of embrittlement, changes in tubing dimensions, weight, and electrical resistivity were determined for a wide range of temperature histories. The degree of protection against embrittlement afforded by a corrosion film previously deposited on the tubing was also investigated. Author (NSA)

N71-16264# Stanford Linear Accelerator Center, Calif.
HIGH POWER KLYSTRON DEVELOPMENT IN THE STANFORD LINEAR ACCELERATOR CENTER
R. L. Stringall and J. V. Lebacqz Sep. 1970 7 p refs Presented at the 8th Intern. Conf. on Microwave and Opt. Generation and Amplification, Amsterdam, 7–11 Sep. 1970 Sponsored by AEC
(SLAC-PUB-804; CONF-700914-1) Avail: NTIS

A brief review of the Stanford klystron development, design and performance, and computer analysis is given. The program was initiated to increase the peak power output of the klystrons so that the beam energy is increased without increasing the number of klystron sockets. Considering power supply limitations and klystron life, an objective peak power output of 34 MW at a beam voltage of 270 kV was established. The end result should be a beam energy of approximately 25 GeV. Also, life experiences of all klystrons used at the accelerator center are reviewed. NSA

N71-16265# Los Alamos Scientific Lab., N.Mex.
NUMERICAL TECHNIQUES FOR STUDYING REPETITIVELY PULSED REACTOR TIME-DEPENDENT BEHAVIOR
G. C. Hopkins Jul. 1970 6 p refs
(Contract W-7405-eng-36)
(LA-4505) Avail: NTIS

Computationally efficient numerical techniques are developed for studying the time-dependent behavior of repetitively pulsed reactors. Reactivity perturbations synchronous with the external pulse are also considered. Three types of reactivity are considered: step change, sinusoidal, and thermal feedback. Noniterative techniques, based upon Laplace transforms and residues, are used to solve the first two types, and continuous analytic continuation is used to solve the third. Author (NSA)

N71-16273# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
PRELIMINARY DESIGN FOR A PHOENIX FUELED HFIR REACTOR
U. P. Jenquin Sep. 1970 48 p refs
(Contract AT(45-1)-1830)
(BNWL-1504) Avail: NTIS

Calculations were performed to determine potential advantages of utilizing Phoenix fuel for the High Flux Isotope Reactor (HFIR). The Phoenix Fuel Program, under which this study was performed, is a research and development project concerned with the use of plutonium fueled systems for extending core reactivity lifetime. The neutronic characteristics of a plutonium fueled HFIR are compared to a uranium fueled HFIR. Utilizing the results of the neutronic investigations, a preliminary plutonium fueled HFIR design is derived. Author (NSA)

N71-16274# Argonne National Lab., Ill.
PROCEEDINGS OF THE CONFERENCE ON FLOW-INDUCED VIBRATIONS IN REACTOR SYSTEM COMPONENTS
May 1970 350 p refs Conf. held at Argonne, Ill., 14-15 May 1970
Contract W-31-109-eng-38)
(ANL-7685; CONF-700535) Avail: NTIS

Papers assessing the state-of-the-art of techniques for the analysis of coolant-flow-induced vibrations of fuel elements, fuel assemblies, control elements, and cooling system components are presented. A separate abstract was prepared for each of the 18 papers. NSA

N71-16279# Westinghouse Electric Corp., Pittsburgh, Pa. Nuclear Energy System Div.
SAXTON PLUTONIUM PROJECT Quarterly Progress Report, Period Ending 30 Jun. 1970
W. R. Smalley Jul. 1970 12 p ref
(Contract AT(30-1)-3385)
(WCAP-3385-24) Avail: NTIS

Progress on the Saxton Plutonium Project during this period included evaluation of all Core 2 post-irradiation data. The discrepancy in beginning-of-life Pu:U ratios was investigated further, and appropriate corrections were applied to all isotopic data. Further studies of archive fuel confirmed that rods containing batch #3 pellets were not locally hydrided prior to irradiation. The reactor operated at full power, with load follow type cycling for about 30 days. The cumulative energy generated during Core 3 operation was 1685 megawatt-days, with a total of 138 load follow cycles. Author

N71-16280# Los Alamos Scientific Lab., N.Mex.
REVIEW OF FLUX SYNTHESIS METHODS
Raymond E. Alcouffe Jun. 1970 9 p refs
(Contract W-7405-eng-36)
(LA-4472) Avail: NTIS

Flux synthesis techniques are reviewed with respect to the types of methods currently employed to obtain the detailed neutron flux from lower-order calculations. The areas considered are reactor statics, including the diffusion and transport equations, and reactor dynamics. Recommendations for the implementation and further development of synthesis methods are also included. Author (NSA)

N71-16282# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
BRT-1: BATTELLE-REVISED-THERMOS
C. L. Bennett and W. L. Purcell Jun. 1970 86 p refs
(Contract AT(45-1)-1830)
(BNWL-1434; UC-32) Avail: NTIS

A FORTRAN 4 program is described which computes the space-dependent thermal neutron density, flux, and current spectra over the energy range 0 to 0.683 eV in either slab or cylindrical geometry. The neutron density is computed from the collision probability form of the integral transport theory matrix equations using either a combination of power iteration, overrelaxation, and extrapolation or straight power iteration. The neutron currents are computed from either the gradient of the scalar flux or the uncollided flux matrix. The flux and current spectra are used to weight point thermal cross sections over an arbitrary thermal energy range for use in multigroup transport or diffusion theory codes. The code requires 64K memory and 3 scratch units, in addition to the normal I/O complement. Typical running time with a random-access library on a Univac 1108 is 1 minute with a reflecting boundary condition and 30 seconds with a white boundary condition; succeeding cases using the same cross sections take about 15 seconds each. NSA

N71-16283# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

METAL SWELLING AND IRRADIATION CREEP EFFECTS UPON THE FAST TEST REACTOR CORE COMPONENT PERFORMANCE

R. J. Jackson, W. H. Sutherland, and I. L. Metcalf Sep. 1970 53 p refs

(Contracts AT(45-1)-1830; AT(45-1)-2170)

(BNWL-1430) Avail: NTIS

An analysis has been performed which predicts the bending distortion in fast reactor core components. It is shown that thermal strains, swelling strains, and irradiation creep strains are all important at some time during the lifetime of these components. It is concluded that irradiation creep greatly ameliorates the bending distortions of these core components. Author (NSA)

N71-16403# Oak Ridge National Lab., Tenn.

[NUCLEAR PHYSICS RESEARCH, AND ACCELERATOR AND ELECTRON MICROSCOPE DEVELOPMENT] Annual Progress Report, Period Ending 31 Dec. 1969

31 Dec. 1969 125 p refs

(Contract W-7405-eng-26)

(ORNL-4534) Avail: NTIS

The nuclear physics activities with the Oak Ridge Isochronous Cyclotron (ORIC) are reported. The activities include continued studies of few-nucleon problems, extensive studies of nuclear reactions and of nuclear properties, and important tests of conservation laws. Nearly half of the projects represent the expanding activities of user groups at ORIC. Groups within other divisions of the Laboratory are pursuing fission studies, new-element production with heavy ions, neutron studies, and investigations of solid-state structures. The review and evaluation of various concepts for multistage acceleration of heavy ions to sufficient energies to produce nuclear reactions between the heaviest of ions is included. Author

N71-16560*# AiResearch Mfg. Co., Los Angeles, Calif.

PRESSURE CONTAINMENT TESTS IN SUPPORT OF THE NUCLEAR BRAYTON CYCLE HEAT EXCHANGER AND DUCT ASSEMBLY (HXDA), PHASE 2

M. G. Coombs, J. C. Gibson, and C. E. Richard 4 Jan. 1971 32 p refs

(Contract NAS3-13453)

(NASA-CR-72815; AiResearch-70-7044) Avail: NTIS CSCL 18L

The pressure containment capability of plate-fin heat exchangers for nuclear reactor Brayton cycle space power systems were evaluated. Representative plate-fin specimens using 347 stainless steel and Hastelloy X with a nickel base and gold base braze alloy were burst tested at room temperature and 800 F and creep rupture tested at 1200, 1350 and 1600 F. Author

N71-16665*# Resalab Scientific, Menlo Park, Calif.

THERMOELECTRIC PROPERTIES OF SILICON-GERMANIUM ALLOYS AS A FUNCTION OF TIME AND TEMPERATURE

19 Oct. 1970 39 p refs Prepared for JPL

(Contracts NAS7-100; JPL-952808)

(NASA-CR-116221; Memo-8) Avail: NTIS CSCL 18E

The long-term-time and temperature dependence of the thermoelectric properties for silicon-germanium alloys are studied. Analytically derived temperature and time dependent properties of electrical resistivity, Seebeck coefficient, and thermal conductivity are graphed for the phosphorus doped n-type 80 a/o Si-20 a/o Ge and for the boron doped p-type alloys. F.O.S.

N71-16666*# Resalab Scientific, Menlo Park, Calif.

EFFECTS OF SUBLIMATION ON SILICON-GERMANIUM RTG PERFORMANCE

4 Nov. 1970 14 p Prepared for JPL

(Contracts NAS7-100; JPL-952808)

(NASA-CR-116224; Memo-9) Avail: NTIS CSCL 18E

Sublimation of the silicon-germanium thermoelement in the multihundred watt radioisotope thermoelectric generator (MHW RTG) is studied to uncover problems related to high temperature operation. The sublimation rate of silicon-germanium alloys, and the effects of sublimation on SiGe thermocouple performance are discussed. It is concluded that operation of the MHW RTG at beginning-of-life temperatures of 1100 C is not advisable, and it is recommended that the RTG be designed for operating temperatures below 1000 C. F.O.S.

N71-16691# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.

AN ANALYSIS OF FUNCTIONAL COMMON-MODE FAILURES IN GE BWR PROTECTION AND CONTROL INSTRUMENTATION

L. G. Frederick et al Jul. 1970 216 p

(NEDO-10189) Avail: NTIS

Analyses of the effects of a broad spectrum of simultaneous multiple functional failures in critical safety and protection equipment in boiling water reactors are presented. Types of common mode failures are described. Protection against these failures is analyzed. The analysis of functional diversity aspects of boiling water reactor instrumentation is emphasized. NSA

N71-16692# Idaho Nuclear Corp., Idaho Falls.

EXPERIMENTAL RESULTS OF THE FUEL HEATUP SIMULATION TESTS (FHUST): EMERGENCY CORE COOLING TEST SERIES

R. J. Jensen Sep. 1970 45 p refs

(Contract AT(10-1)-1230)

(IN-1390) Avail: NTIS

Bench-type bottom flooding coolant injection tests with 9- and 49-rod arrays of 30- and 36-inch uniformly electrically heated rods, respectively, were performed to determine the heat transfer mechanisms occurring during emergency core cooling (ECC) injection and to provide data to be used in developing thermodynamic models for predicting core temperature response during ECC. Several flow and heat transfer regimes occurred. These regimes included convection in water, nucleate boiling at the quenching front, flow film boiling in an annular two-phase flow, film boiling in dispersed two-phase flow, and convection in superheated steam. Author (NSA)

N71-16693# Gulf Radiation Technology, San Diego, Calif.

APPLICATION OF PHOTOINDUCED REACTIONS TO NUCLEAR MATERIALS SAFEGUARDS PROBLEMS Project Summary Report, 1 Jul. 1969 - 30 Jun. 1970

R. L. Bramblett, R. O. Ginaven, T. Gozani, A. T. Hyde, L. A. Kull et al 31 Jul. 1970 133 p refs
(Contract AT(04-3)-167)
(GA-10272) Avail: NTIS

Work performed on the development of techniques and equipment for nondestructive measurement of nuclear materials in various forms such as those encountered in the fabrication and reprocessing of reactor fuel is described. The nondestructive assay methods studied are summarized. The radioactive neutron source method was used for an assay system. The reactor methods have been offered as a commercial service. Several techniques are being developed which use sub-MeV neutrons as the source for active interrogation. Three of these techniques are described; two of them using a Linac as a neutron source and one using a radioactive source (antimony–beryllium). Most of the techniques being developed are based on the use of an electron linear accelerator as a source of radiation for active interrogation of samples. Author (NSA)

N71-16706# Argonne National Lab., Ill.
REACTOR DEVELOPMENT PROGRAM Progress Report, Sep. 1970
23 Oct. 1970 177 p refs
(Contract W-31-109-eng-38)
(ANL-7742) Avail: NTIS

The LMFBR physics and component development is reviewed. Operations and analysis of ZPR-3, ZPR-6, ZPR-9, and ZPPR are described. The EBR-2 research and development projects, fuel fabrication, and operations are summarized. Reactor fuels and materials development, physics studies, engineering development, fuel cycle chemistry, and LMFBR safety studies are reported. NSA

N71-16734# Oak Ridge National Lab., Tenn.
TOWER SHIELDING REACTOR 2 (TSR-2) DESIGN AND OPERATION REPORT. VOLUME 1: DESCRIPTION
L. B. Holland 7 Oct. 1970 97 p refs Sponsored by AEC
(ORNL-TM-2893-Vol-1) Avail: NTIS

The operating history of the TSR-2 is reviewed. The reactor site and facilities are described. Design parameters of the reactor components and systems are presented. Heat transfer and physics measurements are included. Instrumentation is described. NSA

N71-16735# Oak Ridge National Lab., Tenn.
TOWER SHIELDING REACTOR 2 (TSR-2) DESIGN AND OPERATION REPORT. VOLUME 2: SAFETY ANALYSIS
L. B. Holland and J. O. Kolb 7 Oct. 1970 112 p refs Sponsored by AEC
(ORNL-TM-2893-Vol-2) Avail: NTIS

The Tower Shielding Reactor 2 is a spherically symmetrical experimental reactor that was installed at the Tower Shielding Facility in 1960. It is proposed that the TSR-2 be operated at a power level of 1 MW with the three following limitations: (1) the core life will be limited to 3000 MWhr, (2) continuous operation at 1 MW will be limited to periods of 75 hr or less, and (3) operation at a power level of 1 MW will be initiated only if the afterheat from previous operation has decayed to a sufficiently low value. The factors considered in the safety analysis for operation at the proposed power level of 1 MW were the lack of a containment barrier around the primary core coolant system, the operation of the reactor while suspended from the TSF towers, and the minimum exclusion distance of 4085 ft from the reactor to the nearest point of public access at the general exclusion fence. The investigation was directed primarily to the adequacy of the fuel plate cladding as a barrier to fission product release and to the amount of fission product release that could be tolerated under the maximum credible accident conditions. Author (NSA)

N71-16738# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
REACTOR PRIMARY COOLANT SYSTEM RUPTURE STUDY Quarterly Report, Apr.–Jun. 1970
Jul. 1970 48 p
(Contract AT(04-3)-189)
(GEAP-10207; QR-21) Avail: NTIS

Research progress is reported on probability analysis of pipe failure in reactor cooling systems and effects of low-cycle fatigue on crack initiation and growth in carbon steel piping for boiling water reactors. NSA

N71-16739# North Carolina State Univ., Raleigh.
COMPUTER EXPERIMENT STUDIES ON MECHANISMS FOR IRRADIATION INDUCED DEFECT PRODUCTION AND ANNEALING PROCESSES Progress Report, Period Ending 28 Feb. 1970
J. R. Beeler, Jr. Mar. 1970 44 p refs
(Contract AT(40-1)-3912)
(ORO-3912-3) Avail: NTIS

Most of the effort was devoted to finding out how to compute the characteristics of carbon-vacancy and carbon-interstitial complexes in nickel. The configuration energy of the carbon-vacancy complex is a double-valued function of the carbon atom position along a crystallographic direction through the vacancy. This feature was observed in fully dynamic simulations of Frenkel pair production near a carbon atom as well as in the variational and quasi-dynamic calculations where it was first discovered. This property makes the configuration state adopted by a carbon-vacancy complex depend sensitively upon the initial configuration from which the complex evolved. A detailed description of suggested techniques for systematically computing binary impurity-lattice defect complex properties is given. These binary complexes are difficult to treat when the impurity-host atom interaction is significantly stronger than the host-host atom interaction. Author (NSA)

N71-16762# Trans-Tech Translations, Seattle, Wash.
STRUCTURAL CHANGES IN BRIEFLY TREATED URANIUM DIOXIDE WITH AND WITHOUT NEUTRON IRRADIATION AS AN AID IN DETERMINING TEMPERATURE DISTRIBUTION IN FUEL ELEMENTS FOR NUCLEAR REACTORS
J. Hoechel et al 21 Sep. 1970 28 p refs Transl. into ENGLISH from J. Nucl. Mater. (Amsterdam), v. 33, 1969 p 225–241
Prepared for Battelle-Northwest
(BNWL-TR-55) Avail: NTIS

As part of a program involving irradiation of fuel elements, the thermal conductivity of UO2 was measured from room temperature up to the melting point during very short irradiation times. For the low temperature range up to 900 C thermal conductivity was calculated with the help of characteristic changes in the structure of fuels with or without neutron irradiation and taking into account the melting point. The thermal transport from fuel to can was allowed for in making these calculations. A study of grain growth outside the reactor supplied no clear indication of the kinetic processes. All experiments were done with the same starting material. Author

N71-16763# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
OXIDE FUEL ELEMENT DEVELOPMENT Quarterly Progress Report, Period Ending 30 Jun. 1970
Sep. 1970 132 p refs
(Contract AT(30-1)-4135)
(WARD-4135-11) Avail: NTIS

Research is reported on effects of neutrons on stainless

steel-clad oxide fuels. Other work is reported directed toward development of computer programs for calculating oxide fuel behavior over the range of parameters characteristic of the LMFBR. Investigations of radiation effects on unencapsulated oxide fuel pins are described along with testing and development of grid-type fuel assemblies for LMFBR and EBR-2. Development of processes for fabrication of mixed oxide fuel pellets and characterization of these pellets are described. NSA

N71-16764# Argonne National Lab., Ill.
SUITABILITY OF SOME COMPONENTS OF THE EBR-2 SODIUM SYSTEMS FOR OPERATION AT 62.5 MWt. EBR-2 PROJECT
N. Bulut Jul. 1970 59 p refs
(Contract W-31-109-eng-38)
(ANL/EBR-16) Avail: NTIS

In preparing for operation of EBR-2 at 62.5 MW(t), the stress criteria that guided the original design of the major components of the EBR-2 sodium systems were re-evaluated and, in some cases, re-analyzed. The philosophy behind the codes on which the original design was based had changed since that design was completed. The re-evaluation and re-analysis of stresses due to static, thermal steady-state, and thermal transient loadings show that the major components have sufficient structural integrity for 62.5 MW(t) operating conditions. Author (NSA)

N71-16775# Argonne National Lab., Ill.
QUESTIONS CONCERNING THE DETECTION OF THE ENTRY OF WATER INTO SODIUM
V. I. Subbotin et al [1970] 33 p refs Transl. into ENGLISH from the Russian Report
(ANL-TRANS-857) Avail: NTIS

A leak detection method for water and sodium systems is developed. The method is applied to boilers of liquid sodium-cooled fast reactors. The method is based on the diffusion of hydrogen from sodium through a nickel membrane and the continuous monitoring of the gas phase by chromatography. NSA

N71-16778*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Guidance and Control Div.
THERMOELECTRIC GENERATORS FOR DEEP SPACE APPLICATION
P. Rouklove and V. Truscello 15 Jan. 1971 27 p
(Contract NAS7-100)
(NASA-CR-116246; JPL-TR-32-1495) Avail: NTIS CSCL 10B

To provide a source of electrical energy independent of the sun, for the use of unmanned spacecraft investigation of the outer planets, radioisotope thermoelectric generators are evaluated. Criteria for the selection of the thermoelectric materials, the design of the generator, and its integration with the spacecraft are discussed. Results of the tests of 10 generators that have been, or are presently, under test are also presented. Author

N71-16809# Oak Ridge National Lab., Tenn.
FLUORINE PRODUCTION AND RECOMBINATION IN FROZEN MSR SALTS AFTER REACTOR OPERATION
P. N. Haubenreich 30 Sep. 1970 36 p refs
(ORNL-TM-3144) Avail: NTIS

Exposure of capsules of MSR fuel salts in the MTR between 1961 and 1964 showed that when the salt was chilled below about 80 C, F2 was produced by radiolysis at a rate of 0.02 molecules/100 ev. Other experiments confirmed the radiolysis of frozen salt and provided data on the effect of temperature on recombination. The data on yield and recombination have recently been reviewed and used in answering questions involved in storing and disposing of irradiated salt from the MSRE and future moltensalt reactors. The energy source in the MSRE salt is low enough that no fluorine evolution is expected for over a year after heating to induce recombination. Salt from a high-power MSR can be stored in bare cans with no fluorine evolution if the surroundings are kept at about 200 F. Author (NSA)

N71-16810# Scientific Translation Service, Ann Arbor, Mich.
MECHANISMS OF DENSIFICATION OF THE MIXED OXIDE UO2-Pu-O2 DURING IRRADIATION EFFECTS ON FISSION GAS RELEASE
Hubert Mikailoff et al 1970 27 p refs Transl. into ENGLISH of CEA, Fontenay-aux-Roses, France report CEA-N-1254 p 1-32 Prepared for ORNL
(ORNL-TR-2387; CEA-N-1254) Avail: NTIS

Cracks form during power rises and shut-downs of the reactor which are annealed in the very hot zones of the fuel. This sequence of cracking-annealing led to the progressive disappearance of the initial gap and an increase in the diameter of the central cavity. Annealing of cracks modifies the densification structure and increases the fission gas release. To avoid these disturbances, irradiations were carried out at rather high power levels permitting a significant densification to be obtained in a short irradiation period. When reduced to the life of a fuel element, these conditions represent its operation in the transient state during the first hours of reactor irradiation. Author

N71-16815# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
SODIUM-COOLED REACTORS FAST CERAMIC REACTOR DEVELOPMENT PROGRAM Quarterly Report, May-Jul. 1970
Sep. 1970 161 p refs
(Contract AT(04-3)-189)
(GEAP-10028-35; QR-35) Avail: NTIS

The research activities for this period are reported. Topics include: development of fuel elements for the fast ceramic reactor, and development of stainless steel clad plutonium oxide fuel elements for the liquid metal fast breeder reactor. NSA

N71-16824# Argonne National Lab., Ill.
DYNAMIC SIMULATION AND ANALYSIS OF EBR-2 ROD-DROP EXPERIMENTS
A. V. Campise Mar. 1970 72 p refs
(Contract W-31-109-eng-38)
(ANL-7664) Avail: NTIS

The neutronic, thermal, and hydraulic characteristics of EBR-2 were modeled with the AIROS-2A dynamic-simulation program. The radial power and reactivity distributions in core and blanket regions were simulated by dividing the core and inner blanket into individual feedback channels, each representing an average fuel element in various rows of the reactor. Average power and flow rates were used to compute the temperature transients associated with rod-drop experiments; in turn, these temperatures were used with weighted temperature coefficients to compute the many temperature-induced reactivity feedbacks. These computations were applied to recent EBR-2 power runs in which rod-drop experiments had been conducted; the computed results showed very good agreement with experimental data on power level and reactivity feedback for the first 40 sec following the rod drops. Author (NSA)

N71-16825# Argonne National Lab., Ill.
NEW TECHNIQUE FOR INVESTIGATING FEEDBACK AND STABILITY OF A NUCLEAR REACTOR. EBR-2 PROJECT

Ivar A. Engen Jun. 1970 51 p refs
(Contract W-31-109-eng-38)
(ANL-7686) Avail: NTIS

The rod-drop technique for feedback and stability analysis of EBR-2 was evaluated in an attempt to develop a reliable, less expensive method of analysis compared to the established oscillation technique. Oscillation experiments determined system feedback in the frequency domain through use of a Fourier analysis technique. The rod-drop experiments determined the feedback in the time domain through use of an inverse-kinetics computation utilizing linearized, one-group-energy, space-independent, kinetics equations. Data for the computations were obtained from an ion-chamber signal and other signals that monitored the position of the reactivity perturbation mechanism. The two techniques were compared by developing mathematical models representing the feedback. Author (NSA)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N71-15795# National Physical Lab., Teddington (England). Div. of Quantum Metrology.
RAY-TRACING FOR A TWO-MIRROR SPECTROMETER AND OPTIMISATION OF A 1.5 m CZERNY-TURNER INSTRUMENT
R. C. Preston Sep. 1970 34 p refs
(NPL-Qu-13) Copyright. Avail: NTIS

Ray tracing equations for calculating the intensity distribution in the focal plane of a double spherical mirror spectrometer are given. They were used to evaluate the properties of a 1.5 m Czerny-Turner spectrometer, using a high blaze angle Echelle grating. The results showed that the focusing mirror off-axis angle must satisfy the Rosendahl cos cubed relation in order to minimize residual coma and that a stigmatic system is obtained when a slightly divergent beam is incident upon the grating. Curved slits were also investigated in order to retain as much spectral purity as possible. Author (ESRO)

N71-15822# Padua Univ. (Italy). Ist. di Fisica.
OPERATORIAL EXPANSION OF THE PRODUCT OF TWO CURRENTS
L. Bonora and I. Vendramin [1970] 14 p refs
(IFPTH-5/70) Avail: AEC Depository Libraries

On the grounds of general principles and a certain set of hypotheses the most general expansion of the product of two $U(3) \times U(3)$ currents in neighboring space-time points is built up following the Wilson method. By means of this expansion a certain number of current-current and current-derivative of current equal-time commutators are determined. These are in agreement with the results obtained by other methods. As an application, it is shown that the structure of stress-energy tensor suggested by Sugawara can be embodied as a limiting case in Wilson's theory. Author (NSA)

N71-15857 Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
APL TECHNICAL DIGEST, VOLUME 9, NO. 4, MARCH APRIL 1970
Apr. 1970 23 p refs
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1. THEORY OF NERVOUS REGULATION OF INTRAOCULAR PRESSURE R. W. Hart p 2–13 refs (See N71-15858 06-04)
2. SIMPLIFIED METHOD OF HYBRID MICROCIRCUIT FABRICATION F. R. Muccino p 14–20 refs (See N71-15859 06-10)

N71-15860 Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
APL TECHNICAL DIGEST, VOLUME 9, NO. 5, MAY–JUNE 1970
Jun. 1970 17 p refs
(Contract N00017-62-C-0604)
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1. CYCLOTRON RESONANCE IN SOLID-STATE PLASMA T. O. Poehler and J. R. Apel p 2–12 refs (See N71-15861 06-25)
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N71-15864*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A RANDOM DISTRIBUTION OF RADIAL MOTIONS
William R. Thickstun, Jr. Aug. 1970 26 p refs Submitted for publication
(NASA-TM-X-65414; X-643-70-303) Avail: NTIS CSCL 12A

Two quite unrelated problems motivated the efforts described in this report. One pertains to the question of whether a singularity in space-time can develop from an initially nonsingular distribution of matter. The other problem pertains to the initial distribution of comet orbits about the sun from which certain capture theories attempt to predict the observed number of short period comets. For both of these problems it is instructive to start with a model consisting of a random distribution of particles constrained, however, to strictly radial motion in a central gravitational field. Author

N71-15927# Australian National Univ., Canberra.
TRANSVERSE IONIZING SHOCK WAVES IN A PLANAR ELECTROMAGNETIC SHOCK TUBE
Sing Lee (Ph.D. Thesis) Oct. 1969 253 p refs
(NP-18406) Avail: AEC Depository Libraries

The Kunkel-Gross-Chapman-Jouguet hypothesis for the propagation of normal ionizing shock waves was adapted for the description of the transverse ionizing shock waves in the planar electromagnetic shock tube. This was made possible by the adoption of an ohmic dissipation model for the expansion wave, resulting in the choice of the isentropic sound speed as the small disturbance speed. The validity of this choice was established by bow shock measurements. Transverse ionizing shock equilibrium solutions were obtained, based on this C–J model, with extension to the hydromagnetic and the gasdynamic regimes. A new method of Mach–Zehnder interferometry, using multi channel spectra, was used to obtain more accurate measurements of the electron density and the density ratio than could be attained by conventional M–Z methods. An appropximate probe theory was developed to account for the influence of the bow shock on the measurement of the transverse magnetic field and the total pressure. The pre-shock electric field was also measured. Author (NSA)

N71-15961# Army Electronics Command, Fort Monmouth, N.J.
MEASUREMENTS OF NONLINEAR DIELECTRICS
R. Lefker Aug. 1970 19 p refs
(AD-713871; ECOM-3324) Avail: NTIS CSCL 14/2

Pitfalls in the measurement of nonlinear dielectrics are considered and it is shown that to obtain meaningful results, the method of measurement must be investigated. In this report, the dielectric constant of nonlinear dielectrics is discussed as a function of the electric field strength while the other properties of the dielectric material are applicable to the methods employed. A comparison is made of the results of measurements of the capacitance of 60 Hz, 400 Hz, and 1 kHz for three samples prepared by different processes and containing different buffering materials: (1) a commercial BaTiO3 capacitor, (2) a No. 832 capacitor (thick), and (3) an approximately 100% BaTiO3 capacitor (thin). A comparison of their maximum voltage and field strength is also given. Author (GRA)

N71-15977# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTRIC MODELING WITH THE APPLICATION OF VORTEX FIELDS
G. A. Ryazanov Aug. 1970 540 p refs Transl. into ENGLISH from the Russian
(AD-714727; FTD-MT-24-104-70) Avail: NTIS CSCL 20/3

Given are methods for electromagnetic simulation of plane and three-dimensional fields by means of an electric rotational field and a variable magnetic ultrasonic-frequency field with the use of the spin effect. The monograph represents a logical continuation of the book Tests and Simulation in Study of the Electromagnetic Field written by the same author and published in 1966. GRA

N71-15978* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LOW FRICTION MAGNETIC RECORDING TAPE Patent
Pleasant T. Cole and James E. Kupperian, Jr., inventors (to NASA) Issued 4 Oct. 1966 (Filed 25 Apr. 1961) 6 p Cl. 161-189
(NASA-Case-XGS-00373; US-Patent-3,276,946; US-Patent-Appl-SN-105518) Avail: US Patent Office CSCL 14C

The development of a low friction magnetic recording tape is discussed. The reduced friction is obtained by using the dry lubricating characteristics of a fluorocarbon plastic as an antifriction agent to provide a nondeteriorating lubricant for high fidelity recording tapes. NASA

N71-16021# Los Alamos Scientific Lab., N.Mex.
HIGH-VOLTAGE TEST OF A LARGE CRYOGENIC COIL FOR MAGNETIC ENERGY STORAGE SYSTEM
E. R. Lady, D. L. Call, and J. C. Bronson Jun. 1970 10 p refs
(Contract W-7405-eng-36)
(LA-4469) Avail: NTIS

The 1-MJ aluminum coil was tested when warm and when immersed in liquid nitrogen and liquid hydrogen. The coil was energized by a 10-kV, 100-kJ capacitor bank that was crowbarred at the first current maximum. The coil, cryogenic system, and charging network are described and the feasibility of using a pulsed magnetic energy storage coil immersed in liquid hydrogen is demonstrated. Author (NSA)

N71-16088* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INERTIAL REFERENCE APPARATUS Patent
John Dimeff, inventor (to NASA) Issued 15 Jul. 1969 (Filed 22 Mar. 1966) 7 p Cl. 73-505; Int. Cl. G01p15/08
(NASA-Case-XAC-03107; US-Patent-3,455,171; US-Patent-Appl-SN-538168) Avail: US Patent Office CSCL 20L

A large amplitude, linear inertial reference of the vibrating string type is described. The string is end-driven so that the motion of the end of the string is proportional to sin sq (omega t) where omega is the natural frequency of the string. This driving function causes constant tension in the string regardless of vibration amplitude. Official Gazette of the U.S. Patent Office

N71-16099* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POSITION SENSING DEVICE EMPLOYING MISALIGNED MAGNETIC FIELD GENERATING AND DETECTING APPARATUS Patent
Maxwell G. Strange, inventor (to NASA) Issued 28 Apr. 1970 (Filed 17 May 1967) 5 p Cl. 328-1; Int. Cl. G01n27/00
(NASA-Case-XGS-07514; US-Patent-3,509,469; US-Patent-Appl-SN-640453) Avail: US Patent Office CSCL 20C

The magnetic element moves between a pair of fixed electromagnets: one a bar magnet connected to an oscillator and the other a horseshoe magnet connected to a phase detector through a limiting amplifier. The oscillator is also connected to the phase detector. The bar magnet is misaligned with the ends of the horseshoe magnet to create a bias voltage on the horseshoe magnet's output. When the magnetic element moves between the bar and horseshoe magnets it creates a phase shift in the output of the horseshoe magnet. This phase shift rapidly passes through zero at a well defined point. This point is detected by a phase detector and a pulse-forming network creates an output pulse. Official Gazette of the U.S. Patent Office

N71-16100* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OPTICAL TRACKER HAVING OVERLAPPING RETICLES ON PARALLEL AXES Patent
Edward J. Devine, inventor (to NASA) Issued 6 Oct. 1970 (Filed 15 Sep. 1967) 11 p Cl. 250-233; Int. Cl. G01d5/36; Int. Cl. G01j5/20
(NASA-Case-XGS-05715; US-Patent-3,532,894; US-Patent-Appl-SN-668257) Avail: US Patent Office CSCL 17H

An optical tracker comprises a pair of frequency modulation reticles, positioned on separate transparent overlapping carriers so that the two reticle patterns are spatially phase displaced by 90 deg relative to an image of a tracked object. A single photodetector responds to the image chopped by the two reticles to drive X and Y signal channels through an FM discriminator. Official Gazette of the U.S. Patent Office

N71-16101* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
POLARIMETER FOR TRANSIENT MEASUREMENT Patent
Alan R. Johnston, inventor (to NASA) Issued 14 Jul. 1970 (Filed 15 Feb. 1967) 8 p Cl. 356-117; Int. Cl. G01n21/44 Sponsored by NASA
(NASA-Case-XNP-08883; US-Patent-3,520,617; US-Patent-Appl-SN-617021) Avail: US Patent Office CSCL 17H

A polarimeter is described which is capable of measuring transient birefringence changes in electro-optic materials on a nanosecond time scale, without the requirement for manual analyzer adjustment. An optical assembly is employed by means of which light polarized in a first plane is transmitted through the test material and a quarter wave plate. The output is light polarized in a plane rotated about the first plane by an angle, proportional to the transient birefringence changes. The output of a photomultiplier, which responds to the output light intensity of the polarimeter, is sampled at specific times, measured from the leading edges of field pulses applied to the material. The samples produce an average

error signal, and drive a Faraday cell, forming part of a feedback loop, such that the transient birefringence changes could be measured in terms of Faraday-cell current.
Official Gazette of the U.S. Patent Office

N71-16110# California Univ., Los Angeles. Dept. of Physics.
EXPERIMENTS IN SOLIDS AND LIQUID METALS BY NMR, LIGHT SCATTERING IN SUPERFLUIDS Final Report
W. Gilbert Clark and Michael A. Woolf 30 Sep. 1970 10 p
(Grant AF-AFOSR-1528-68)
(AD-714095; AFOSR-70-2477TR) Avail: NTIS CSCL 7/4

The results of a research program on the following topics are briefly summarized: Nuclear magnetic resonance and relaxation in liquid rubidium, liquid gallium, liquid lanthanum, and liquid gallium antimonide; Nuclear quadrupolar relaxation in III - V compounds; Quantum oscillations in the Knight shift of InSb; Low temperature properties of the type A and B spin-lattice relaxation peaks in InSb; Hindered rotation of heavy water molecules in potassium oxalate monohydrate; and Experimental measurements of the velocity and attenuation of second sound in superfluid mixtures of He3 and He4 by light scattering. Author (GRA)

N71-16187# Los Alamos Scientific Labs., N.Mex.
MEDIUM-ENERGY PHYSICS PROGRAM Quarterly Status Report, Period Enging 31 Jul. 1970
Sep. 1970 43 p refs
(Contract W-7405-eng-36)
(LA-4514) Avail: NTIS

Progress is reported on the development of accelerator structure, RF power systems, accelerator control and instrumentation, accelerator physics, and the experimental area. The status of LAMPF scheduling and facility construction is outlined, and meetings of the LAMPF users group are reported. Also, progress in experimental physics research is outlined, including the proton-Comptom experiment, the pion absorption experiment, and the development of multiwire proportional counters. (NSA)

N71-16211# Florida State Univ., Tallahassee. Dept. of Physics.
THEORY OF FERRIMAGNETIC INSULATORS, ALLOYS, AND MAGNETIC IMPURITIES Final Report
Paul Erdos Oct. 1970 12 p refs
(Contract AF-AFOSR-1745-69)
(AD-714096; AFOSR-70-2501-TR) Avail: NTIS CSCL 20/3

The electronic structure of uranium ions in insulating host materials has been determined, enabling one to explain the magnetic behavior of the uranium iodide and oxide compounds. The optical properties of the laser ion, chromium, in GdAlO3 have been explained. The cause of the anomolous behavior of the magnetic susceptibility of Ce compounds has been understood. The behavior of helimagnets in magnetic fields has been studied and the phase diagrams in external magnetic fields have been constructed. The electronic conductivity of a one-dimensional model for a substitutional alloy and of a multilayer semiconductor has been determined. Finally, new methods for the solution of the transport equation in solids have been developed and applied in the areas of heat transport through insulators and neutron transport through reactors. Author (GRA)

N71-16212* Aerojet-General Corp., Sacramento, Calif.
PROCESS OF FORMING PARTICLES IN A CRYOGENIC PATH Patent
Robert H. Globus, inventor (to NASA) Issued 23 Jun. 1970 (Filed 13 Jun. 1968) 5 p Cl. 149-1; Int. Cl. C06d5/00 Sponsored by NASA
(NASA-Case-NPO-10250; US-Patent-3,516,879; US-Patent-Appl-SN-736848) Avail: US Patent Office CSCL 20L

A method and apparatus are described for producing fine particles of less than one micron diameter by gasifying the substance to be produced in fine particles. The substance is maintained in the gaseous state while injecting it through a small orifice below the surface of a cold, preferably cryogenic bath, in which fine particles of the material are produced. Preferably the material in the gaseous state is diluted with an inert gas prior to its injection into the cryogenic bath. Useful gelled propellants can be formed in accordance with this method through the production of fine particles of a reactive component in a cryogenic propellant.
Official Gazette of the U.S. Patent Office

N71-16253# Sperry Rand Research Center, Sudbury, Mass.
MAGNETOELASTIC SURFACE WAVES Final Report, 1 Oct. 1969 – 30 Sep. 1970
Herbert Matthews Oct. 1970 35 p refs
(Contract N00014-69-C-0027)
(AD-713993; SRRC-CR-70-23) Avail: NTIS CSCL 20/1

The properties of magnetoelastic Love waves in the simplest structure are reviewed. The theory and properties of magnetoelastic Love waves in epitaxial magnetic films are described. Certain properties are shown to be nonreciprocal. The conditions necessary to obtain parallel pumped parametric excitation of magnetostatic surface waves are found and these conditions discussed. Experiments with loaded Rayleigh waves in CdS layered YIG are described. These experiments extend to 415 MHz, the upper frequency at which surface waves in layered substrates have been generated, propagated and detected. The reciprocal interaction of these loaded Rayleigh waves with volume magnetostatic waves is discussed. Author (GRA)

N71-16254# Boston Univ., Mass. Dept. of Physics.
INVESTIGATION OF SOLID ISOTOPE HELIUM 3 IN SUPPORT OF AEROSPACE MATERIALS REQUIREMENTS Final Report
George O. Zimmerman 30 Sep. 1970 12 p refs
(Grant AF-AFOSR-1770-69)
(AD-714094; AFOSR-70-2453TR) Avail: NTIS CSCL 20/3

The report covers the investigation of weakly interacting magnetic systems at very low temperatures. The weakly interacting magnetic systems which were covered in this investigation were helium three-a nuclear magnetic substance, cerium magnesium nitrate, - a paramagnetic salt. The lowest temperatures were achieved in the experiment on cerium magnesium nitrate with the aid of high field magnets. In addition a phase transition in chromium potassium sulphate at 200K was investigated by means of ultrasonic velocity measurements. Author (GRA)

N71-16263# Florida State Univ., Tallahassee. Dept. of Physics.
STUDIES OF SOLIDS AT LOW TEMPERATURES Final Scientific Report
William G. Moulton 8 Oct. 1970 15 p refs
(Grant AF-AFOSR-0928-67)
(AD-714689; AFOSR-70-2542TR) Avail: NTIS CSCL 20/3

One of the primary objectives of this research has been to investigate the magnetic properties of materials which are likely to exhibit unusual magnetic transitions which may prove to be useful for microwave or switching devices. Experimental techniques used in this research included nuclear magnetic resonance, magnetic susceptibility measurements, optical spectroscopy, and electron spin resonance. A second goal was to develop relationships between magnetic properties and chemical bonding so that eventually magnetic properties could be predicted from the structure of a compound. Another objective of this research was to investigate the possibility of superconductivity in the fluoro-tungsten bronzes. Forty-two of these compounds were synthesized and all were found to have superconducting transition temperatures between one and

one half degrees and five degrees Kelvin. Relationships between the critical fields and the transition temperature and the composition have been established. Author (GRA)

N71-16337# Naval Undersea Research and Development Center, San Diego, Calif.
LIGHT-SCATTERING MEASUREMENTS OFF THE SAN DIEGO COAST Technical Publication, Jul. 1966 – Aug. 1967
J. W. Reese and S. P. Tucker Oct. 1970 47 p refs
(AD-714481; NUC-TP-203) Avail: NTIS CSCL 20/6

From 1966 to 1967, absolute volume-scattering measurements for seawater (to depths of 700 m) were conducted in San Diego using an in situ light-scattering meter. Scattering from latex spheres was measured to determine if the instrument was properly calibrated. Volume-scattering functions for ocean waters varied considerably through the first 100 m, but were uniform beyond this depth. Deep water was found to be clear, while scattering and attenuation -- discounting motes -- approached data for distilled water. In addition, the size and amount of scattering matter, inferred from the scattering function, decreased with depth. Attempts to measure light scattering in regions of high acoustical scattering were not successful. Author (GRA)

N71-16338# Naval Underwater Systems Center, New London, Conn.
SPECTRUM OF A SIGNAL REFLECTED FROM A TIME-VARYING RANDOM SURFACE
Albert H. Nuttall and Benjamin F. Cron 25 Aug. 1970 103 p refs
(AD-714482; NUSC-NL-3013) Avail: NTIS CSCL 17/1

The power density spectrum of the received acoustic waveform after reflection off the time-varying random sea surface is evaluated at an arbitrary observation point in the farfield. For a monochromatic transmitted signal and a narrow-band Gaussian surface-height variation, the received acoustic spectrum is shown to consist of an impulse at the transmitted acoustic frequency plus sidelobes centered at frequencies separated from the transmitted frequency by multiples of the surface center frequency. The powers in the coherent component and scattered sideband components of the received pressure waveform are evaluated in terms of the surface roughness and spatial-temporal correlation function of the surface. For the special case of elliptical contours of iso-correlation at zero time delay, the sideband powers and scattering strengths are evaluated in terms of two fundamental parameters that include the geometry of the experiment, the incident acoustic frequency, the root mean square (rms) surface height, and the surface correlation distances. The rms bandwidths of the sideband scatter components are evaluated for small surface roughness and shown to be approximately proportional to the square root of the sideband number. Numerous examples of sideband scattering strengths for a variety of spatial correlation functions, including exponential and Gaussian decay as special cases, are given. Author (GRA)

N71-16341* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ELLIPSOIDAL MIRROR REFLECTOMETER INCLUDING MEANS FOR AVERAGING THE RADIATION REFLECTED FROM THE SAMPLE Patent
Joseph C. Richmond and Stuart Thomas Dunn, inventors (to NASA) Issued 7 Apr. 1970 (Filed 31 May 1966) 7 p Cl. 356-209; Int. Cl. G01n21/45
(NASA-Case-XGS-0529; US-Patent-3,504,983; US-Patent-Appl-SN-553891) Avail: US Patent Office CSCL 17H

An ellipsoidal mirror reflectometer for measuring the reflectance of materials is described, which includes a source of monochromatic light, an ellipsoidal mirror reflector with an aperture, a specimen support position at the first focal point of the reflector, means for directing the monochromatic light through the aperture onto the support and an averaging sphere detector positioned adjacent to a second focal point of the reflector. The first and second focal points are on a common axis normal to the first focal plane of the reflector. Shields are utilized with the reflectometer to provide a more accurate system and to permit the determination of flux losses in the system. Official Gazette of the U.S. Patent Office

N71-16385* Hazleton Labs., Falls Church, Va.
LIGHT DETECTION INSTRUMENT Patent
Duane G. Hoffman and Emmett W. Chappelle, inventors (to NASA) Issued 14 Jul. 1970 (Filed 9 Sep. 1966) 7 p Cl. 23-253; Int. Cl. G01n1/14, 31/14 Sponsored by NASA
(NASA-Case-SGS-05534; US-Patent-3,520,660; US-Patent-Appl-SN-578925) Avail: US Patent Office CSCL 17H

An apparatus is described for producing, detecting, and measuring light, emitted as a result of an ATP-luciferin-luciferase biochemical reaction. The apparatus includes a reactant holder containing cuvettes slidably mounted and a syringe holder containing a syringe positionable with respect to the cuvettes to permit injection of the ATP containing sample into any one of the cuvettes. The light quanta emission, from the reaction in the cuvette, is detected and coupled in the form of an electrical signal to an indicator. The syringe is operated hydraulically by a servomechanism which insures that the indicator operates only when injection takes place. Official Gazette of the U.S. Patent Office

N71-16386* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
OPTICAL CHARACTERISTICS MEASURING APPARATUS Patent
Charles Ernest Gray, inventor (to NASA) Issued 1 Sep. 1970 (Filed 27 Jun. 1967) 6 p Cl. 356-36; Int. Cl. G01n1/00, 21/00, 33/28 Sponsored by NASA
(NASA-Case-XNP-08840; US-Patent-3,526,460; US-Patent-Appl-SN-649360) Avail: US Patent Office CSCL 17G

An apparatus for measuring the effect of outgassing material in vacuum on the optical characteristics of optical elements. The apparatus includes a source of light providing a beam partially directed to a first photocell to monitor changes in the light from the source. The rest of the light beam is directed to a second photocell through optical elements, whose optical characteristics as affected by outgassing material, is to be measured. The optical elements and the material are included in a chamber which can be evacuated. The vacuum in the chamber causes the material to outgas which results in condensation of molecules on the optical elements, affecting their light transmission or light reflectance characteristics. The changes in such optical properties are measured as a function of changes in the output of the second photocell. Official Gazette of the U.S. Patent Office

N71-16389# Los Alamos Scientific Lab., N.Mex.
WAVELENGTHS AND ENERGY LEVELS OF SINGLY IONIZED COPPER, Cu(II)
Charles B. Ross Aug. 1970 73 p refs
(Contract W-7405-eng-36)
(LA-4498) Avail: NTIS

For the purpose of calculating wavelength standards in the vacuum ultraviolet spectral region, the spectrum of singly ionized copper, Cu(II) was investigated photographically from 1979 to 11227 A using plane and concave grating spectrographs and Fabry-Perot interferometers. The light source employed was a water-cooled, hollow-cathode discharge tube operated with helium or neon. In the wavelength region studied, 1968 lines were measured, 1011 of them interferometrically, and 1125 lines are newly observed. In the analysis, 102 new energy levels were

identified, bringing the total number of known even levels to 173, and the odd to 178. The wavelengths of 485 lines in the vacuum ultraviolet region were calculated using the Ritz combination principle. Of these, 409 lines, with uncertainties of 0.0001 to 0.0005 A, are recommended for use as wavelength standards. Author

N71-16401# Fordham Univ., New York.
STUDY OF MAGNETIC ALLOYS: CRITICAL PHENOMENA Annual Report, 1 Jun. 1969 – 31 May 1970
J. I. Budnick, M. P. Kawatra, J. A. Mydosh, and S. Skalski Oct. 1970 39 p refs
(Contract N00014-69-A-0175-0001)
(AD-714014) Avail: NTIS CSCL 20/3

The technical report describes research carried out in the areas of transport studies and magnetic susceptibility of magnetic alloy systems, both dilute and concentrated, of PdFe, PtFe, AuFe, CuNi and some rare earth Laves phase compounds. In these studies a special emphasis was placed on the behavior in the close vicinity of the ordering temperature. Author (GRA)

N71-16405# Naval Research Lab., Washington, D.C.
THE HIGH-FREQUENCY SUSCEPTIBILITY OF CERTAIN SUPERPARAMAGNETIC FERRITES
R. O. Pilon 1 Oct. 1970 21 p refs
(AD-714485; NRL-7153) Avail: NTIS CSCL 20/3

The susceptibility of small crystallites of nickel and nickel-iron ferrite, precipitated in the manner of Schuele and Deetscreek, has been studied as a function of hydrothermal growth and frequency. The degree of superparamagnetism shown by nickel ferrite crystallites grown for various periods is correlated with the broadening of the microwave resonance, and the paramagnetic relaxation frequency is found to be approximately 6 GHz. An equation has been developed which describes the size and temperature dependence of the low-frequency susceptibility of single-domain ferrite particles. The effects of ferrous ion content and solution pH on the growth rate and the susceptibility after long growth periods are related. Efforts to reduce the internal fields in the particles and increase the susceptibilities to quasi ferrimagnetic levels are discussed. Author (GRA)

N71-16406# Massachusetts Inst. of Tech., Cambridge. Acoustics and Vibration Lab.
FINITE MEMBRANES AND PLATES VIBRATING IN A DENSE FLUID: AN ANALYSIS OF THE FULLY COUPLED PROBLEM
William T. Ellison Jun. 1970 128 p refs
(Contract N00014-67-A-0204-0030)
(AD-714281; A/V-71476-2) Avail: NTIS CSCL 20/1

The analysis of the transmission of sound through a clamped circular plate set in an infinite rigid wall, exposed on both sides to a dense acoustic medium and excited by an obliquely incident plane wave is undertaken. The analysis is accomplished by an approximate variational solution to the coupled integral equations describing the problem. Expressions are obtained for the transmitted far field intensity and power and the displacement response. Results are also included for a practical example of a steel plate submerged in water. In addition, an experimental analysis of the complementary problem of transmission of sound through a circular membrane set in an infinite rigid wall has been accomplished and the results of this analysis are compared with the corresponding variational solution for a membrane. Author (GRA)

N71-16445# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
STIMULATED RAMAN AND CONCENTRATED SCATTERING Quarterly Technical Report, 1 Apr. – 30 Sep. 1970
N. Bloembergen, H. Lowdermilk, M. Matsuoka, and C. S. Wang Oct. 1970 43 p refs Supported in part by NSF
(Contract DAHC04-68-C-0037; ARPA Order 675)
(AD-714172; TR-1) Avail: NTIS CSCL 20/6

Two reports are presented. In the first, from the general formulation of the coupling of a laser wave and a scattered light wave with density, temperature and concentration fluctuations in a binary fluid mixture, an expression for the gain g(c) of stimulated concentration scattering was derived. It was shown that this gain is usually much smaller than the gain for stimulated Brillouin scattering, g(B). However, in gaseous mixtures at relatively low pressures, with a large difference in polarizability as well as in mass between the two components, g(c) can become larger than g(B). A large difference in polarizabilities increases the coupling of light to the concentration fluctuations, while a large difference in mass produces a pronounced increase in damping of a sound wave. The calculated values for g(c)/g(B) are compared with experimental results. In the second briefer report the observation of stimulated Rayleigh scattering caused by concentration fluctuations in a non-absorbing binary gaseous mixture of SF6 and He is discussed. The experimental results are in good agreement with theoretical expectations. Author (GRA)

N71-16489*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN ON-BOARD SPACECRAFT OPTICAL DATA PROCESSING SYSTEM USING PARABOLOIDAL MIRROR SEGMENTS AND A GALLIUM ARSENIDE LASER
Akrams. Husain Abidi Jan. 1971 17 p refs Submitted for publication
(NASA-TM-X-65432; X-711-71-4) Avail: NTIS CSCL 17H

A compact and rugged optical system for on-board spacecraft is described. A GaAs laser is used as a coherent monochromatic source of radiation. Paraboloidal mirror segments are used as collimating, Fourier transforming, and image reconstructing elements. The system is capable of performing a number of operations such as analysis in spatial frequency plane, single frequency filtering to remove coherent noise, spatial low frequency reduction to remove the effects of glare, and pattern recognition and extraction. Some preliminary experimental results are presented. Author

N71-16531# Cornell Univ., Ithaca, N.Y. Center for Radiophysics and Space Research.
INFRARED SPECTROSCOPY Semiannual Technical Report, 15 Nov. 1969 – 31 May 1970
James R. Houck, Barrie W. Jones, Judith L. Pipher, an Baruch T. Soifer 1 Jun. 1970 18 p refs
(Contract F19628-70-C-0128; ARPA Order 1366)
(AD-714570; AFCRL-70-0500; SATR-1) Avail: NTIS CSCL 17/5

The report briefly describes research progress in four areas: Detectors for the wavelength range 5 microns to 30 microns; Detectors for the wavelength range 65 microns to 1.5 mm; A lamellar grating for detector calibration in the far infra-red; and Black paint for far infra-red cryogenic use. Author (GRA)

N71-16659# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
HEAT AND MASS TRANSFER IN A MAGNETIC FIELD
Yu. A. Mikhailov Jan. 1971 20 p refs Transl. into ENGLISH from Magnitnaya Gidrodinamika (USSR), no. 1, 1969
(TR-60) Avail: NTIS

The basic trends in the development of magnetohydrodynamics are examined and the importance of a comprehensive investigation of the heat and mass transfer processes for this development is demonstrated. The nature of the magnetic field's influence on heat and mass transfer is illustrated by MHD flow of an incompressible liquid. The existence in MHD flows of an analogy between the heat transfer and isothermal mass transfer is proved, as is the possibility of an approximate simulation of high temperature heat and mass transfer processes in a magnetic field by analogs performed at low temperatures. Features of MHD flows of a two-phase electrically conducting system in channels and of the transport phenomena arising in such flows are indicated. Author

N71-16660*# LTV Research Center, Anaheim, Calif.
TECHNIQUES FOR EVALUATING THE SOUND ABSORPTION OF MATERIALS AT HIGH INTENSITIES
John G. Powell and John J. Van Houten Washington NASA Jan. 1971 77 p refs
(Contract NAS1-8763)
(NASA-CR-1698) Avail: NTIS CSCL 20A

Two unique methods applicable to evaluation of the sound absorption characteristics of materials have been investigated. The effort concentrated on methods suitable for evaluating materials under consideration for sound reduction treatment in jet engine nacelles. Since many sound absorbing materials become nonlinear at the sound intensities encountered in the intake and fan exhaust ducts, a need exists for a convenient method of testing at these intensities in the laboratory. Both techniques evaluated during this study are capable of fulfilling this requirement. The methods investigated involve a tone-burst technique and a shock-tube procedure. Author

N71-16661# State Univ. of New York, Binghamton. Dept. of Physics and Astronomy.
ON SOME ASPECTS OF THE QUANTUM MECHANICS OF ROTATIONS
E. Deci, N. Greenberg, D. McLoughlin, R. Penfield, and S. Raboy [1970] 56 p refs
(Grant NSF GP-10673)
Avail: Issuing Activity

Operator and matrix representations of the Rotation Group are obtained for passive and active rotations. An attempt is made to keep the treatment free of inconsistencies and ambiguities which appear to be present in the literature on the subject. The commutators of the angular momentum operators are derived for a laboratory fixed reference frame and for a reference frame fixed in a moving physical system. Author

N71-16758# Los Alamos Scientific Lab., N.Mex.
VELOCITY OF SOUND IN IRON AND IRON ALLOYS IN THE SOLID AND MOLTEN STATE
W. Kurz and B. Lux May 1970 21 p refs Transl. into ENGLISH from High Temp. - High Pressures (England), v. 1, 1969 p 387–399 Sponsored in part by Concast AG Co., Zurich and Battelle Mem. Inst., Geneva
(LA-tr-70-21) Avail: NTIS

The longitudinal velocity of sound in Armco iron and in three steels (a 0·12 C structural steel, a plain carbon (1·10 C) tool steel, and an 18/9 Cr/Ni stainless steel) has been measured in the solid state up to the melting point and in melts up to 1700 C. The velocity of sound in Armco iron at the melting point is approximately 4600 m/sec in the solid state and 3930 m/sec in the liquid state. The apparatus used is described, and the results are discussed and compared with those of other investigators. Author

N71-16789# National Electrotechnical Inst., Turin (Italy).
DEPENDENCE OF THE LIGHT DISTRIBUTION ALONG A SINGLE EL LINE FROM FREQUENCY AND AMPLITUDE OF THE EXCITING VOLTAGE
Piero Brovetto, Gianluigi Busca, Cesare Cortese, and Adriana Mojoni. Aug. 1970 45 p refs
(Contract EOOAR-0074-70)
(AD-714631; AFOSR-70-2579TR; SR-2) Avail: NTIS CSCL 20/3

The light distribution along a single EL line is investigated as a function of frequency and amplitude of the applied voltage. It is found that the brightness decreases from the head towards the tail of the comet following the exponential law: B = B(o)e to the minus x/L power; where L, being almost constant versus the frequency, depends linearly on the amplitude of the exciting voltage. Theoretical considerations, founded on a model previously advanced, are developed which show how these new experimental results can be readily accounted for. Author (GRA)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N71-16727# United Kingdom Atomic Energy Authority, Risley (England). Authority Health and Safety Branch.
USE OF THE UK NUCLEAR DATA LIBRARY IN THE MONTE CARLO PROGRAM MONK
P. J. Hemmings 1970 55 p refs
(AHSB(S)R-184) Avail: AEC Depository Libraries

The need for nuclear data by a neutron or gamma ray transport code based on the Monte Carlo method is discussed. It is shown how the data library may be used and how data may be stored in a convenient manner for ready access. Subroutines which use this nuclear data to determine collision points and the consequences of collisions are described. A subsidiary code POND4 which preprocesses the original data library is also described. Author (NSA)

N71-16728# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Angewandte Kernphysik.
HIGH RESOLUTION NEUTRON SCATTERING MEASUREMENTS AND THE ANALYSIS OF RESONANCE ANGULAR MOMENTUM AND PARITY
J. Nebe and G. J. Kirouac Apr. 1970 10 p Presented at the Joint Meeting of the German and Dutch Phys. Soc., Eindhoven, Netherlands
(KFK-1189; CONF-700417-1) Avail: AEC Depository Libraries

The assignment of neutron resonance spins and parities by direct examination of the differential scattering spectrum shape as a function of energy at a few scattering angles is discussed. The test case shown concerns the well known C-12 (n,n) scattering cross section in the energy range 2 to 6 MeV. Some of the highly structured Ca-40 scattering data are also shown. Author (NSA)

N71-16729# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Neutronenphysik und Reaktortechnik.
NEUTRON NUCLEAR DATA COMPILATION AND EVALUATION: PAST, PRESENT, AND FUTURE
J. J. Schmidt Dec. 1969 23 p refs
(EURFNR-782; KFK-1075; EANDC(E)-124-U) Avail: AEC Depository Libraries

In response to the increasing demands of the nuclear community, a world-wide organizational effort has developed over the last 10 years for the compilation and evaluation of all experimental information in the field of neutron nuclear data. Supra-regional committees, such as the European American Nuclear Data Committee with its local subcommittees and the International Nuclear Data Committee, have made substantial contributions to the international organization and coordination of this effort. At present the task of getting the bibliographic and experimental information systematically compiled, stored, and distributed to a variety of customers throughout the world is subdivided primarily among four centers; at Obninsk in the USSR, at the IAEA in Vienna, through the ENEA at Saclay in France, and at Brookhaven in the USA. These centers also provide for the storage and exchange of evaluated neutron nuclear data files originating from various laboratories around the world. Author (NSA)

N71-15730# Saha Inst. of Nuclear Physics, Calcutta (India). Theoretical Nuclear Physics Div.

PCAC CONSISTENCY CONDITION AND RHO-MESON CONTRIBUTION IN S-WAVE FOR ON-SHELL PION-N SCATTERING

Haridas Banerjee and Samir Mallik [1970] 11 p refs
(SINP-TH-68-2) Avail: NTIS

Assuming unsubtracted backward dispersion relations for physical pion-N scattering, one can obtain the PCAC consistency condition and relate the contributions from the rho-meson to S-wave scattering lengths with those from the dominant P-wave singularities. The on-shell derivation emphasizes the analogy between the PCAC consistency condition and the Goldberger-Treiman relation. Author (NSA)

N71-15733# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).

PERTURBATION THEORY WITH REGULAR POTENTIALS, HARD CORE POTENTIALS, AND BOUNDARY CONDITION MODEL INTERACTION IN THE NUCLEAR BOUND-STATE PROBLEM, 1

C. Natoli and F. Palumbo 13 May 1970 13 p refs
(RT/FI-(69)55) Avail: AEC Depository Libraries

It is shown that the eigenvalues of a system of particles bound by the interaction described by the boundary condition model do not depend on the interaction inside the core while the eigenfunctions are indeterminate. These properties of exact solutions often are not exhibited by the approximate ones, because of the inadequate mathematics involved. As an example the core volume contribution to the G matrix is considered. Author (NSA)

N71-15734# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).

FISPRO 2: A FORTRAN 4 CODE FOR FAST NEUTRON RADIATIVE CAPTURE CALCULATIONS

V. Benzi, G. C. Panini, and G. Reffo 15 Oct. 1969 28 p refs
(RT/FI-(69)44) Avail: AEC Depository Libraries

The physical models and the program FORTRAN 4 written for the radiative capture cross-section calculations on the Hauser and Feshbach theory bases, are described. Direct and collective capture and (n, 2 gamma) process are also taken into account by means of simplified models. Author (NSA)

N71-15743# Institute of Nuclear Research, Warsaw (Poland).

DOSE MEASUREMENTS BY FERROUS-FERRIC, FERROUS-FERRIC WITH COPPER ADDED AND OXALIC ACID DOSIMETERS

R. K. Broshkevich and Z. Bulkhak 1970 12 p refs In RUSSIAN
(INR-1164) Avail: AEC Depository Libraries

The methods of the dose and the dose rate measurements of the ionizing radiation using three dosimeters are described. These include: (1) ferrous-ferric dosimeter for the range of doses from 1000 to 30,000 rads; (2) ferrous-ferric dosimeter with copper added for the range of doses from 0.4 to 10 Mrads; and (3) oxalic acid aqueous solution for the range of doses from 0.3 to 20 Mrads. Author (NSA)

N71-15744# Ohio State Univ., Columbus. Dept. of Chemistry.

PULSE RADIOLYSIS STUDIES OF FAST REACTIONS IN MOLECULAR SYSTEMS Annual Progress Report, 19 Aug. 1969–27 Aug. 1970

Leon M. Dorfman 27 Aug. 1970 4 p
(Contract AT-(11-1)-1763)
(COO-1763-16) Avail: NTIS

Absolute rate constants at 25 C for the addition reaction of H atoms, produced by the electron pulse radiolysis of gaseous hydrogen, with O2, CO, NO, and ethylene, and the relative third body efficiencies of hydrogen and argon in these reactions were determined. The optical absorption band of the solvated electron produced by the electron pulse radiolysis of a weakly polar liquid, tetrahydrofuran (THF), was studied to wavelengths beyond 20,000 A at room temperature using a fast infrared detection system. The absorption maximum in THF was found to be 2.1 + or − 0.1 microns. NSA

N71-15745# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Angewandte Kernphysik.

TOTAL CROSS SECTIONS OF Sc-45, Ti-47, Ti-49, Cr-53, AND Ni-61 IN THE keV REGION

M. Cho, F. H. Froehner, M. Kazerouni, K.-N. Mueller, and G. Rohr Jun. 1970 16 p refs Presented at the 2d Intern. Conf. on Nucl. Data for Reactors, Helsinki
(EURFNR-808; KFK-1230; CN-26/11-A; CONF-700605-6) Avail: AEC Depository Libraries

Neutron total cross sections of separated isotopes were measured with a time of flight spectrometer using a 3 MeV Van de Graaff accelerator as neutron source. The neutron energy ranged from 10 to 250 keV. The energy resolution was between 0.2 and 0.5 nsec/m. The cross sections were shape analyzed in terms of an R-matrix multilevel formula. Thus, neutron widths and spins for up to 50 resonances per isotope could be determined. Average neutron widths, level densities, and strength functions were derived. The spin dependence of strength functions and the distribution of widths and spacings were investigated. Author (NSA)

N71-15747# Naval Research Lab., Washington, D.C.

REPORT OF NRL PROGRESS, OCTOBER 1970

Oct. 1970 39 p refs
Avail: NTIS CSCL 20H

Discussions are presented on transient optical absorption by self-trapped excitons in alkali halide crystals and on the use of LiF-Teflon disks as accident dosimeters in identification passes. Brief descriptions are also given on the following areas of research: information processes for arrays of sensors; thermal stability of trinitrilotriacetic acid and its salts in aqueous solutions; electromagnetic wave ducting in the ionosphere; tropospheric forward scatter over seawater; antenna applied research; entire functions of extreme rates of growth; triple-layer antireflection coating; and various physical metallurgical projects. N.E.N.

N71-15748# Naval Research Lab., Washington, D.C. Optical Materials Branch.

TRANSIENT OPTICAL ABSORPTION BY SELF-TRAPPED EXCITONS IN ALKALI HALIDE CRYSTALS

R. T. Williams *In its* Rept. of NRL Progr., Oct. 1970 Oct. 1970

p 1-10 refs (See N71-15747 08-24)
Avail: NTIS CSCL 20H

Transient absorption spectra produced by pulsed electron excitation at low temperature were identified as being due to transitions originating in the lowest triplet states of the self-trapped exciton. The current model (comprising an electron plus a self-trapped hole) is shown to provide electronic configurations for the excited states which give a good account of the principal features of the spectra. Author

N71-15762# Uppsala Univ. (Sweden). Inst. of Physics.
INTERNAL FIELDS AND RELAXATION EFFECTS FOR Dy IN FERROMAGNETIC TbAl2 STUDIED BY PAC
R. Weappling, E. Karlsson, G. Carlsson, and M. M. Bajaj Feb. 1970 24 p refs
(UUIP-684) Avail: AEC Depository Libraries

The magnetic hyperfine field for Dy in TbAl2 was measured in the temperature range 1.5 to 130 K using the PAC technique (Perturbed Angular Correlation). Thermal equilibrium after the radioactive decay was not reached during the observation time and the effective field was therefore reduced. The role of electronic spin relaxation in PAC is discussed in detail. The relaxation time was measured between 4 K and room temperature and was found to be of the order of psec. The temperature variation of the hyperfine field is consistent with the trend expected from a molecular field model. Author (NSA)

N71-15763# Uppsala Univ. (Sweden). Inst. of Physics.
ELECTRON INTERACTION IN TRANSITION METAL X-RAY EMISSION SPECTRA
Boerje Ekstig, Elisabeth Kaellne, Erik Noreland, and Rolf Manne Apr. 1970 28 p refs
(UUIP-702) Avail: AEC Depository Libraries

The K beta sub 1 beta prime structure was investigated experimentally for all pure elements of the first transition series and for some of their compounds. Analogous structures were found for L emission spectra of some second transition series elements as well as of gadolinium. Relative transition energies and probabilities are calculated in a frozen-orbital approximation for the transition from a normal K state to singly ionized states for the elements Sc through Ni. The results support the interpretation that the K beta sub 1 beta prime structure is due to the electron interaction between partially filled 3p and 3d subshells. The electron interaction mechanism also explains the effects in the heavier elements investigated. Author (NSA)

N71-15764# Atomic Energy Establishment, Winfrith (England).
REVIEW OF THERMAL NEUTRON DIFFUSION DATA FOR HEAVY WATER AND ITS CONSEQUENCES FOR NEUTRON SCATTERING LAW MODELS
A. T. D. Butland and C. T. Chudley Nov. 1969 36 p refs
(AEEW-R-685) Avail: AEC Depository Libraries

The form and origins of the effective width and Honeck models for thermal neutron scattering in heavy water are briefly described. The validity of the derived cross sections is tested in a practical manner by comparisons with available integral data on the neutron diffusion coefficient of heavy water and with differential measurements of the total neutron cross section. Author (NSA)

N71-15769# Democritus Nuclear Research Center, Athens (Greece).
LOW ENERGY PION-PION RESONANCES IN THE VENEZIANO MODEL
N. G. Antoniou and G. M. Papaioannou May 1970 13 p refs
(DEMO-70/9) Avail: AEC Depository Libraries

An attempt is made to impose elastic unitarity on the forward pi-pi scattering using the Veneziano amplitude together with a crossing symmetric subtraction term as an input. The N/D method is used, and the rho,sigma mesons are interpreted as CDD poles. The self consistency requirement led to the evaluation of the low energy parameters and the S and P-wave phase shifts. Author (NSA)

N71-15777# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Nazionali di Frascati.
ASYMMETRY IN SINGLE PION PHOTO-PRODUCTION BY POLARIZED GAMMA-RAYS ON PROTONS
G. Bologna, F. L. Fabbri, P. Spillantini, and V. Valente 29 Jul. 1970 4 p refs Presented at the 15th Intern. Conf. on High Energy Phys., Kiev, USSR
(LNF-70/39; CONF-700806-37) Avail: AEC Depository Libraries

The asymmetry ratio for the process gamma + p yields pion(0) + p by linearly polarized gamma-rays is reported for E gamma = 280 to 600 MeV and for a pion(0) production angle in the c.m. system theta sup X = 90 deg. Author (NSA)

N71-15778# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
COHERENT EFFECTS IN SLOW NEUTRONS SCATTERING ON LOCAL VIBRATIONS
V. Z. Kochmarskii 1970 22 p refs In RUSSIAN
(ITF-70-30) Avail: AEC Depository Libraries

The differential cross section for slow neutron scattering on local vibrations in various symmetries was obtained for a first order impurity atom concentration and considering the dynamical matrix local change. An impurity interaction with its nearest neighbors in a cubic crystal was considered as an example. It is shown that the dependence of the differential cross section on the momentum transfer is determined by the local vibration symmetry. This fact may be used to help identify local vibrations. Author (NSA)

N71-15779# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Atomnoi Energii.
CONCERNING THE SOLUTION OF THE PROBLEM OF FEW NUCLEONS
V. D. Efros 1969 30 p refs In RUSSIAN
(IAE-1879) Avail: AEC Depository Libraries

The methods of solving the few-nucleon problem with realistic forces based on the K-harmonics method are developed. Author (NSA)

N71-15780# Uppsala Univ. (Sweden). Inst. of Physics.
HYPERFINE INTERACTIONS IN Ho(Er)Al2
R. Weappling, E. Karlsson, G. Carlsson, and M. M. Bajaj Mar. 1970 23 p refs
(UUIP-695) Avail: AEC Depository Libraries

The Perturbed Angular Correlation technique (PAC) was used to study the effect of the cubic crystal field on the electronic levels of Er(3+) ions in HoAl2 and it was found that the crystal field splitting is very small. The electronic relaxation time was determined at 295, 80, and 4 K and the results support a spin-spin relaxation mechanism. The hyperfine field acting on an Er-166 nucleus at 4 K was obtained as 3.5 + or - 1.3 MG. The nuclear g-factor of the 6(+) state at 545 keV in Er-166 was found to be +0.16 + or - 0.04. The order of magnitude of the g-factor of the 7(+) state at 1375 keV was evaluated to 0.2. Author (NSA)

N71-15781# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Angewandte Kernphysik.
NEUTRON TOTAL, SCATTERING AND (n,x) REACTION

CROSS SECTIONS ABOVE THE RESONANCE REGION
S. Cierjacks May 1970 30 p refs Presented at the 2d Intern. Conf. on Nucl. Data for Reactors, Helsinki
(EURFNR-786; KFK-1201; IAEA-CN-26/113; CONF-700605-5) Avail: AEC Depository Libraries

The present status of neutron facilities used for fast neutron cross section measurements is surveyed. A few topics are then discussed in some detail. In the important area of total neutron cross sections, several examples of new high resolution data are shown. Comparisons of other data with optical model calculations are also considered. Scattering cross section measurements are reviewed and the sphere transmission method, associated gamma ray method and time-of-flight method are discussed. Finally the area of (n,x) reaction cross sections is briefly reviewed. Concluding remarks are made concerning the accuracy of presently available data. Author (NSA)

N71-15782# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
VARIATION-ITERATIONAL CALCULATION OF THE THREE NUCLEONS BINDING ENERGY
V. Ja. Antonchenko and I. V. Simenog 1970 14 p refs
(ITF-70-31) Avail: AEC Depository Libraries

The wave functions of the strong coupling constant method of a series of inverse coupling constant are used as the test functions to calculate the three nucleon ground state energy. An analysis of the energy dependence on the function approximation order ŵas carried out for several simple paired potentials. A simple interpretation of variation parameters is given, and the mean-square radii and form factors are calculated. Author (NSA)

N71-15783# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.
MEASUREMENT OF THE CROSS SECTION RATIO OF THE RADIATIVE CAPTURE AND (ALPHA) FISSION FOR U-235 AND PU-239 IN THE RESONANCE REGION OF NEUTRON ENERGIES
Yu. V. Ryabov, So Ton Sik, N. Chikov, and M. A. Kurov 1970 28 p refs In RUSSIAN
(JINR-P3-5113) Avail: AEC Depository Libraries

The cross section ratio of the radiative capture and (alpha) fission for U-235 and Pu-239 is measured by the time-of-flight method in the neutron energy region of 0.1 – 30 keV with resolution of 60 nsec/m. Author (NSA)

N71-15784# Saha Inst. of Nuclear Physics, Calcutta (India). Theoretical Nuclear Physics Div.
DYNAMICAL APPROACH TO HIGHER SYMMETRIES
H. Banerjee and B. Dutta Roy [1969] 34 p refs
(SINP-TH-69-5) Avail: AEC Depository Libraries

It is shown that the family of sum rules recently proposed provides a very convenient framework for the realization of higher symmetry relations among the trilinear hadron couplings. These sum rules are derived assuming unsubtracted dispersion relations for the forward as well as the backward elastic hadronic scattering amplitudes. The remarkable feature of the sum rule is that for the scattering of hadrons of intrinsic parities eta-1 and eta-2 contributions from states with parity eta-1 eta-2 are suppressed (for meson-meson scattering they are entirely absent). It is, therefore, argued that the sum rules for meson-meson and meson-baryon scattering considered will be very well saturated by the states belonging to the SU(6) 35-plet of negative parity mesons and the 56-plet of positive parity baryons respectively. The consistency of this principle of saturation may be easily checked if one further assumes the universality of rho-meson coupling to hadrons. In the meson-baryon sector, assuming SU(3) symmetry, one obtains the SU(6) results in the static limit. Author (NSA)

N71-15785# Atomic Weapons Research Establishment, Aldermaston (England).
MEASUREMENTS OF PROMPT ANTINEUTRINOS FOR Pu-239 BETWEEN 40 keV AND 1.2 MeV
D. S. Mather, P. F. Bampton, G. James, and P. J. Nind Aug. 1970 12 p refs
(AWRE-O-42/70; EANDC(UK)-121-AL) Avail: AEC Depository Libraries

A large liquid scintillation counter was used to measure average values of prompt antineutrino for the neutron-induced fission of Pu-239 over 11 energy bands below 1.2 MeV. The energy bands were 40 to 115, 115 to 285, and 100 keV wide from 300 keV to 1.2 MeV. The relative accuracy was 1%. Author (NSA)

N71-15786# Paris Univ., Orsay (France). Lab. de l'Accelerateur Lineaire.
MEASUREMENT OF THE CROSS SECTION FOR ELECTRON-POSITRON SCATTERING AT HIGH ENERGY AND THE VALIDITY OF QUANTUM ELECTRODYNAMICS
Dominique Lelanne (Ph.D. Thesis) Jun. 1970 150 p refs In FRENCH
(LAL-1235) Avail: AEC Depository Libraries

The absolute cross section of the positron electron yields positron electron reaction was determined from a number of elastic scattering events. This measurement necessitated the exact determination of the luminosity of the Orsay storage ring. This was achieved by detecting the gamma ray photons emitted in the double bremsstrahlung reaction: positron electron yields positron electron photon photon. The mechanisms involved in the operation of the lead scintillator sandwich counters were described in detail. The analysis of the elastic electron positron scattering events necessitated a thorough study of all the possible causes of systematic and statistical errors. An accuracy of approximately two percent was obtained for the cross sections. A comparison with theoretical results gave the limit of the validity of quantum electrodynamics. The lower limit for the cut off parameter Lambda obtained was Lambda > 2 GeV. NSA

N71-15791# Osaka Univ. (Japan).
DUAL STRUCTURE IN PION N SCATTERING
Norio Kawaguchi Aug. 1970 18 p refs
(NP-18417) Avail: AEC Depository Libraries

The modified finite-energy sum rule, which is applicable to general amplitudes including the Veneziano-type amplitude, is derived and discussed. New structures of the dual amplitude for the pion N charge-exchange process are also discussed. From these structures and the modified FESR one gets alpha sub 0 = 0.43 + or − 0.12 for the intercept of the rho trajectory. Author (NSA)

N71-15792# Saha Inst. of Nuclear Physics, Calcutta (India). Theoretical Nuclear Physics Div.
PION-PION SCATTERING LENGTHS FROM A CLASS OF NONLINEAR LAGRANGIAN MODELS
Avinash V. Khare and T. Pradhan 21 Mar. 1969 15 p refs
(SINP-TH-69-4) Avail: AEC Depository Libraries

A class of nonlinear Lagrangian models is proposed, most of which gives S-wave pion-pion scattering lengths that are widely different from those obtained from Weinberg's current algebra calculations. Author (NSA)

N71-15793# Saha Inst. of Nuclear Physics, Calcutta (India).
PHOTOPRODUCTION SUM RULES: A TEST FOR PURE AND ABSORPTIVE REGGE MODELS
D. P. Roy 18 Aug. 1969 10 p refs
(SINP-TH-69-8) Avail: AEC Depository Libraries

Contrary to a previous assertion it is shown that a suitable choice of pion photoproduction sum rules makes a clear distinction between pure and absorptive pion pole exchanges and strongly disagrees with the latter on the basis of existing experimental data.
Author (NSA)

N71-15794# Saha Inst. of Nuclear Physics, Calcutta (India). Theoretical Nuclear Physics Div.
DIRECT (p,n) REACTION IN Li-7
Jayanti Mahalanabis [1970] 27 p refs
(SINP-TH-68-4) Avail: AEC Depository Libraries

The (p,n) reaction in Li-7 at 94 MeV was studied in the impulse approximation. The differential cross section exciting the isobaric analog state and 0.431-MeV state in Be-7 are obtained using the L-S coupled shell model wave functions. Fairly good shape agreement with the available experimental results is obtained. These results are discussed as a mode of investigating the model wave functions used together with the inelastic proton scattering to the 0.478-MeV state in Li-7, where the small-angle results as predicted by the theory appear to be in conflict with the experimental data. Need for more experimental data at small angles for these reactions is stressed. Author (NSA)

N71-15796# Institut d'Aeronomie Spatiale de Belgique, Brussels.
STRUCTURE OF THE 0-0 TO 13-0 ROTATION BANDS OF THE SCHUMANN-RUNGE SYSTEM OF THE OXYGEN MOLECULE [STRUCTURE DE ROTATION DES BANDES 0-0 A 13-0 DU SYSTEME DE SCHUMANN-RUNGE DE LA MOLECULE D'OXYGENE]
F. Biaume 1970 104 p refs In FRENCH; ENGLISH summary
Its Aeronomica Acta No. A-75-1970
Avail: NTIS

A new study of the rotational structure of the 0-0 to 13-0 bands of the molecular oxygen Schumann-Runge system was performed using a high resolution spectrograph. The 0-0 band was measured for the first time and precise values of molecular constants for the 7-0 to 11-0 bands were determined. Previous results derived from high resolution spectra were confirmed and important measurements concerning predissociation line broadening are also presented. Author (ESRO)

N71-15798# Joint Inst. for Nuclear Research, Dubna (USSR). Lab of Nuclear Reactions.
SYNTHESIS OF ELEMENT 105 (SPONTANEOUS FISSION)
G. N. Flerov, Yu. Ts. Oganesyan, Yu. V. Lobanov, Yu. A. Lazarev, S. P. Tret'Yakova et al 1970 24 p refs In RUSSIAN
(JINR-P7-5164) Avail: AEC Depository Libraries

When bombarding Am-243 with Ne-22 ions an emitter of the spontaneous fission fragments with tau sub 1/2 = (1.8 + or − 0.6) sec was recorded; its yield corresponds to the cross section for the branch of spontaneous fission. An integral angular distribution of the Am-243 + Ne-22 reaction products and the dependence of the production cross section of a new isotope on the Ne-22 energy are measured. It follows from these data and the analysis of the check experiment results that the atomic number of the isotope, being spontaneously fissionable with tau sub 1/2 = (1.8 + or − 0.6) sec, is 105. The spontaneous fission of isotopes 256, and 257 of Element-103 were studied. It is shown that for these nuclei the half-life is more than 10 to the fifth power sec with respect to the spontaneous fission. The properties of the isotope 258 of Element 103 are discussed on the basis of experimental data. Author (NSA)

N71-15799# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
ATMOSPHERIC Kr-85 NUISANCE
R. Pannetier 1970 39 p refs In FRENCH Presented at the 2d Congr. of the Intern. Radiation Protection Assoc., Brighton, England
(CEA-CONF-1550; CONF-700505-8) Avail: AEC Depository Libraries

The world distribution of Kr-85 is found to be uniform in the atmosphere. The amount of krypton dissolved in the world water being 2% of the amount of atmospheric krypton and the isotope Kr-85 being at a lower isotopic concentration, the amount of Kr-85 dissolved in water is found to be negligible. A M. P. C. equal to 3 pCi/g of Kr-85 is selected for workers. The curve representing the variation of krypton specific radioactivity in France from 1954 until now indicates a multiplication by ten during the first nine years. The total amount of atmospheric Kr-85 may be estimated by means of the contribution of the nuclear explosions and that of the nuclear power plants. The contribution of power plants should increase from 1/3 to 2/3 of the total contamination in 1980 and should represent the total contamination in the year 2000. The engaged dose notion is used in order to evaluate the consequences of Kr-85 atmospheric disposal. The storage of Kr-85 and radioactive gaseous effluents by underground disposal constitutes a satisfactory solution. Author (NSA)

N71-15800# Skoda Works, Pilsen (Czechoslovakia). Nuclear Power Plants Div.
OPTIMUM TREATMENT OF POISSONS PULSE TRAIN USING SEQUENTIAL ANALYSIS
F. Drab Dec. 1969 30 p refs
(ZJE-64) Avail: AEC Depository Libraries

The method considers the measurement of a parameter of a Poisson's pulse train as a problem of the statistical decision, i.e. as hypothesis testing which leads to the measurement optimization from the point of view of time and accuracy. This method is compared to the existing measurement methods and a number of possible applications are discussed. Some numeric relations for the symmetrical binary testing are developed.
Author (NSA)

N71-15801# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
SCATTERING CROSS SECTION MEASUREMENTS WITH A SOLID STATE NEUTRON SPECTROMETER
L. Frittolli and F. Vinci 1 Apr. 1970 33 p refs In ITALIAN
Avail: AEC Depository Libraries

A solid-state neutron spectrometer was used to measure the elastic and inelastic scattering cross sections in natural silicon and magnesium at 3.24 MeV neutron energy. The values obtained from the processed experimental data are in good agreement with those of literature. Author (NSA)

N71-15802# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
APPROXIMATION FOR SELF-SHIELDING
M. W. Bunder and A. Keane Apr. 1970 18 p refs
(AAEC/TM-539) Avail: AEC Depository Libraries

Self-shielding data for U-238 were fitted to a three-parameter formula for inclusion in the GYMEA library. With dilution and temperature variations included it is not possible to reproduce the results exactly but the work has aimed at reproducing the correct effective resonance integral while making the contribution to each group as correct as possible. Author (NSA)

N71-15803# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Nazionali di Frascati.
THE e(+)e(−) ANNIHILATION INTO HADRONS
S. Ferrara, M. Greco, and A. F. Grillo 22 May 1970 4 p refs
Its Note no. 447
(LNF-70/21) Avail: AEC Depository Libraries

Some predictions on positron electron annihilation into hadrons are presented. These predictions are based on a statistical model for the inelastic e + p scattering and the parton theory of electromagnetic interactions of hadrons. NSA

N71-15810# Technische Hochschule Stuttgart (West Germany). Inst. fuer Kernenergetik.

ANISOTROPIC NEUTRON DIFFUSION IN HETEROGENEOUS SYSTEMS [ANISOTROPE NEUTRONENDIFFUSSION IN HETEROGENEN SYSTEMEN]

Hans-Dietrich Saur (Ph.D. Thesis) 1970 69 p refs In GERMAN (Rept-6-49) Avail: NTIS

Using the first flight theory, two definitions of the diffusion coefficient valid for infinite homogeneous media are transferred to general heterogeneous systems. The definitions are transferred by the mean free path method and by the migration area and absorption cross section. More explicit calculations of the diffusion tensor are made for plane, sphere, and general cylindrical geometry. Programs are written for finite one-dimensional systems and the Wigner-Seitz cell. The difference between the two methods is demonstrated in multigroup calculations. Author

N71-15811# Tokyo Univ. (Japan). Inst. for Nuclear Study.

AVERAGE RANGE-ENERGY RELATION OF MUONS OF ENERGIES ABOVE 10(12)eV AND ITS FLUCTUATION

Motohiko Nagano 1 Jun. 1970 27 p refs (INSJ-120) Avail: AEC Depository Libraries

The average range energy relations of muons in standard rock of muon-nucleon interaction. The fluctuation of the range around the average is estimated by means of the Monte Carlo method. The energy spectra of the vertical muons at sea level derived from the depth-intensity relation are presented for the various assumptions considered. Author (NSA)

N71-15812# Democritus Nuclear Research Center, Athens (Greece).

GROUP THEORETICAL CALCULATION OF THE VENEZIANO PARTIAL WIDTHS FOR PION-PION SCATTERING

E. Kyriakopoulos May 1970 18 p refs (DEMO-70/13) Avail: AEC Depository Libraries

A general formula of the Veneziano partial widths for 2 pion elastic scattering is obtained within the group SO(3,2). Recursion relations for the widths are given. Author (NSA)

N71-15814# Hamburg Univ. (West Germany). II. Inst. fuer Experimentalphysik.

HAMBURG UNIVERSITY'S SECOND INSTITUTE FOR EXPERIMENTAL PHYSICS ANNUAL REPORT, 1969 [II. INSTITUT FUER EXPERIMENTALPHYSIK DER UNIVERSITAET HAMBURG JAHRESBERICHT 1969]

J. Braunsfurth, ed. Jul. 1970 80 p refs In GERMAN; ENGLISH summary (BMBW-FBK-70-9) Avail: AEC Depository Libraries

Research progress is reported on nuclear and elementary particle physics and solid state physics using the synchrotron radiation of DESY. In nuclear physics, mainly reaction mechanisms, nuclear moments, and hyperfine interactions are studied. The experiments are performed by means of a 3 MeV van de Graaff generator, a 30 MeV isochronous cyclotron, and radioactive sources. Elementary particle physics is accomplished in association with research groups at DESY. Research is focused on production processes and reaction mechanisms of elementary particles. Author (NSA)

N71-15816# Padua Univ. (Italy). Ist. di Fisica.

MULTICLUSTER MODEL FOR VERY HIGH ENERGY COLLISIONS

A. Bassetto and F. Paccanoni Jul. 1970 22 p refs Prepared jointly with Ist. Nazl. d. Fis. Nucl., Padua (IEPTH-8/70) Avail: AEC Depository Libraries

With a suitable choice of kinematical variables a multicluster model is studied for very high energy processes, improving the agreement of the theoretical predictions with experimental multiplicities of secondaries and mean transverse momenta. The consequences of this model on the forward absorptive part of the elastic amplitude are examined in the energy regions where diffraction dissociation dominates. An example is given where a consistency condition determines the character of the leading singularity responsible for the high energy behavior of the total cross section. Author (NSA)

N71-15817# Kernforschungszentrum, Karlsruhe (West Germany). Literaturabteilung.

EQUILIBRIUM DEFORMATION OF NUCLEI WITH NEUTRON EXCESS IN THE REGION A APPROXIMATELY 100 [GLEICHGEWICHTSDEFORMATIONEN VON KERNEN MIT NEUTRONEN- UEBERSCHUSS IM BEREICH A UNGEFAEHR 100]

D. A. Arseneu et al [1970] 18 p refs Transl. into GERMAN from Akad. Nauk SSSR, Moscow, report JINR-P4-4660 In GERMAN (KFK-tr-313; JINR-P4-4660) Avail: AEC Depository Libraries

Microscopic calculations of the equilibrium deformations for the ground state of even–even nuclei were made in the regions $28 < Z < 50$, $50 < N < 82$. The calculation method is described and the results are discussed. The following conclusions were made. The nuclei investigated were weaker with respect to beta and gamma deformation than the nuclei of the rare earth region. The deformation energy has a maximum of 4 MeV in comparison with 8 MeV for rare earth nuclei. These nuclei are apparently weaker with respect to the beta deformation than the nuclei in the region $50 < Z, N < 82$. The energy minimum of the nuclei is either at gamma = 60 deg or 0 deg, i.e., the axial symmetric form is found in equilibrium. The flat rotation ellipsoid is the equilibrium form for most of the nuclei. The sensitivity of the calculated results to a change of the parameter of the Nilsson potential and the pair interaction constants is to be expected. Author (NSA)

N71-15818# Padua Univ. (Italy). Ist. di Fisica.

EQUAL TIME COMMUTATORS FROM BROKEN CONFORMAL INVARIANCE AND IMPLICATIONS FOR ASYMPTOTIC SUM RULES

S. Ciccariello, R. Gatto, G. Sartori, and M. Tonin [1970] 83 p refs Prepared jointly with Ist. Nazl. di Fis. Nucl., Padua (IFPTH-7/70) Avail: AEC Depository Libraries

A non-Lagrangian field theory is developed, extending some ideas by Wilson. The theory is based on simultaneously broken conformal invariance and chiral U(3) symmetry. Systematic use of the invariance properties allows for calculation of all the equal time commutators among the currents and densities in terms of some parameters. Applications of the theory to asymptotic electroproduction and neutrino production sum rules are considered. In particular, neutrino-production sum rules are determined from electroproduction sum rules. When a plausible assumption is introduced for the behavior of the longitudinal scale function at omega = 0, all asymptotic sum rules depend only on one parameter. Author (NSA)

N71-15837*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXCITED STATES OF CERIUM 138 AND PRASEODYMIUM 138 POPULATED BY BETA DECAY

Glenn M. Julian and Theodore E. Fessler Washington Jan. 1971

24 p refs
(NASA-TN-D-7040; E-5576) Avail: NTIS CSCL 20H

Gamma rays emitted in the beta decay of 2.02-hour Pr-138m, 1.44-minute Pr-138, and 5.7-hour Nd-138 were studied with a Ge(Li) spectrometer. Eighteen gamma rays (plus annihilation radiation) were attributed to the decay of Pr-138m. These can be fitted into a level scheme of Ce-138 with excited levels as follows: 788.8, 2+; 1826.4, 4+; 2129.1, 7-; 2217.3; 2765.0; and 3799.9 keV. Twelve gamma rays were attributed to the decay of Pr-138. These were used to establish the following excited levels in Ce-138: 788.8, 2+; 1477.0, 0+; 1510.9, (2+); 2236.8; and 2340.3 keV. The most interesting result is the discovery of the (2+) level of Ce-138 at 1510.9 keV. The possible interpretation of this level is discussed, together with the 0+ level at 1477.0 and the 4+ level at 1826.4 keV, as a vibrational triplet of states. In addition, seven gamma rays attributed to the decay of Nd-138 were fitted into a level scheme of Pr-138 with excited levels at 193.6, 199.0, 325.9, and 540.8 keV. Author

N71-15838# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Angewandte Kernphysik.
ABSOLUTE NEUTRON FLUX DETERMINATION
F. Kappeler et al [1970] 9 p refs Transl. into ENGLISH of German conf. paper KFK-1226 Presented at 2d Intern. Conf. on Nucl. Data for Reactors, Helsinki, 15-19 Jun. 1970 Sponsored by AEC-EURATOM
(EURFNR-805; KFK-1226; CN-26/9; Conf-700605-9) Avail: AEC Depository Libraries

A proton recoil counter with a solid radiator and a solid state detector for absolute measurements of neutron beam fluxes above 250 keV is described. The geometry is such that only protons emerging within a narrow cone around the forward direction are detected. Thus only relatively high-energy protons reach the detector and background correction is facilitated. A specially developed Monte Carlo program is used to normalize the spectra. The counter is fast enough (18 nsec time resolution) for many time of flight applications. Author (NSA)

N71-15847# Grenoble Univ. (France). Faculte des Sciences.
STUDY OF THE EXCITED LEVELS OF BORON 10 IN THE 7.5 MeV REGION
Andre Bontemps (Ph.D. Thesis) 1970 77 p refs In FRENCH
(NP-18438) Avail: AEC Depository Libraries

In order to establish a better understanding of the excited levels of B-10 between 7.35 and 7.8 MeV, the reactions Be-9(p,p)Be-9, Be9(p, alpha)Li-6 and Be-9(p, gamma)B-10 were studied using proton energies between 0.6 and 1.5 MeV. It was shown that the excitation curve of Be-9(p,p) could be taken into account by introducing p and d waves into the analysis; the Be-9(p, alpha) reaction involved two mechanisms; a compound nucleus mechanism and a direct mechanism. NSA

N71-15870# Institute of Nuclear Research, Warsaw (Poland).
THE ENERGY STABILIZATION SYSTEM FOR THE VAN de GRAAFF ACCELERATOR LECH
A. Ben'Kovski, E. Gurski, L. Zemlo, Z. Katspshak, M. Leshchinski et al 1970 15 p refs In RUSSIAN
(INR-1181) Avail: AEC Depository

The fast and slow stabilization systems of energy installed in the Van de Graaff accelerator Lech are described. The energy stability is better than + or - 0.0007 in the beam energy range from 400 to 2400 keV. Author (NSA)

N71-15872# Brookhaven National Lab., Upton, N.Y.
FEASIBILITY OF UTILIZING A MICROTRON ELECTRON ACCELERATOR FOR NUCLEAR MATERIALS ASSAY
J. R. Beyster Jun. 1970 26 p refs Prepared for AEC
(BNL-50250) Avail: NTIS

Results of an investigation aimed at identifying a type of accelerator capable of performing neutron and gamma interrogation are presented. An evaluation of accelerators is presented including machine operation, strong points and limitations of the machine, and recommendations. NSA

N71-15873# Kernforschungszentrum, Karlsruhe (West Germany).
INFLUENCE OF CHARGE DISTRIBUTION ON BETA DECAY [EINFLUSS DER LADUNGSVERTEILUNG AUF DEN BETA-ZERFALL]
M. Vinduska [1970] 9 p refs Transl. into GERMAN from Russian report UJV-1022/64 In GERMAN
(KFK-tr-320; UJV-1022/64) Avail: AEC Depository Libraries

The effect of the nuclear charge distribution on the beta decay was investigated. The nucleus with diffuse surface and its effect on the electron wave functions were discussed. The results of the calculations show that the difference between the electron functions in nuclei with diffuse surface and nuclei in which this effect was not considered was 10 to 15%. Author (NSA)

N71-15879# Johns Hopkins Univ., Baltimore, Md. Dept. of Biochemistry.
EVIDENCE FOR nc YIELDS PION TRANSITION IN N-MALONIC ESTERS OF HETEROCYCLIC COMPOUNDS
John C. Nnadi and Shih Yi Wang [1968] 21 p refs
(Contract AT(30-1)-2798)
(NYO-2798-48) Avail: NTIS

In aqueous solutions, the UV spectra of N-malonic ester-substituted uracils, phthalimide, pyridone, and aniline were determined from pH 1 to 12.8. For the uracils, carbanion formation at higher pH is accompanied by a two- to sixfold hyperchromicity. For phthalimide, pyridone, and aniline, carbanion formation leads to an intense peak at the 240 to 280 nm region in addition to those observed for the undissociated molecules. In acetonitrile, the UV spectra of the sodium salts of these compounds show the same hyperchromicity and the appearance of new peaks when compared with those of the initial compounds. The effects are rationalized in terms of an electronic transition from the nonbonding p-orbital of carbanions to the π^* orbital of the aromatic system, overlapped on normal uracil spectra in the case of uracil derivatives, but completely distinct for phthelimido-, pyridono-, and anilino-malonic esters. Using these effects, the dissociation constants of these compounds were obtained. Author

N71-15880# Oak Ridge National Lab., Tenn.
THERMONUCLEAR DIVISION Annual Progress Report, Period Ending 31 Dec. 1969
Aug. 1970 179 p refs
(Contract W-7405-ENG-26)
(ORNL-4545) Avail: NTIS

Research progress is reported on atomic and molecular physics, magnetics and superconductivity, toroidal confinement, high-beta plasma, turbulent heating, plasma theory and computation, target plasmas, injection and accumulation, energetic particle injection, and fusion feasibility. R.S.

N71-15881# California Inst. of Tech., Pasadena.
A HODOSCOPE/SPECTROMETER FOR HIGH-ENERGY PHOTONS
C. A. Heusch, R. V. Kline, C. Y. Prescott, and S. J. Yellin [1968] 19 p refs Presented at the Intern. Conf. on Instrumentation for High Energy Phys., Dubna, USSR Prepared jointly with Calif. Univ., Santa Cruz
(Contract AT(11-1)-68)
(CALT-68-255; CONF-700902-5) Avail: NTIS

In conjunction with an experimental project that demands the best possible resolution of both the trajectory and the energy of photons in the energy region between 0.15 and 0.7 GeV, a detection system was developed which combined Cerenkov and wire chamber techniques to yield the relevant kinematical parameters in this region, but is applicable up to very high energies. The essential features are the use of lead glass for photon conversion as well as for energy detection, with interleaved wire chambers giving the desired information on shower location. Addition of signals from the converters to that from the main lead glass block was found to result in pulse height information equivalent in precision to that obtained from a single lead glass block. Trajectory information is obtained by reconstructing the conversion vertex from shower tracks in several subsequent wire chambers, with an accuracy depending on the geometry used. Author (NSA)

N71-15891# Athens Univ. (Greece). Dept. of Theoretical Physics.
SOLUTIONS OF BETHE-SALPETER EQUATION
F. T. Hadjioannou and E. Kyriakopoulos Jul. 1970 20 p refs Prepared jointly with Democritus Nucl. Res. Center
(NP-18418) Avail: AEC Depository Libraries

The Lorentz symmetry of the Bethe-Salpeter equation is studied in the light-like case for two scalar quarks of different masses interacting via the exchange of a scalar photon. A new approach was developed for solving the eigenvalue problem of the equation for the general case (not only the light-like). Accurate analytic expressions for the spectrum and the wave functions were calculated. Author (NSA)

N71-15897*# Maryland Univ., College Park, Md. Center for Theoretical Physics.
AN s-WAVE I = 0 PION PION RESONANCE
Bryan F. Gore Aug. 1970 50 p refs
(Grants NsG-398; NSF GY-5461)
(NASA-CR-116135; TR-71-012) Avail: NTIS CSCL 20H

Solutions are presented for subtracted dispersion relations, written for the s and p-wave inverse pion pion scattering amplitudes with (CDD) poles inserted into both s-waves. These solutions predict the existence of a super broad I = 0 s-wave resonance (sigma) accompanied by a small, negative I = 2 phase shift, in the absence of any s-wave experimental input whatsoever. While p-wave subtraction parameters are adjusted to fit a 755 MeV rho resonance with width 120 MeV, the s-wave parameters are determined by crossing symmetry through derivative conditions to third order. Author

N71-15938*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
ON THE SPHERICAL SYMMETRY OF THE EXCHANGE POTENTIAL PRODUCED BY A CLOSED SHELL
Saul T. Epstein 13 Nov. 1968 2 p
(Grant NGL-50-002-001)
(NASA-CR-116125; WIS-TCI-327) Avail: NTIS CSCL 20H

A direct numerical proof of the spherical symmetry of the exchange potential produced by a closed shell is presented. Equations and mathematical models to prove the theorem are included. Author

N71-15948# Technische Hochschule Hannover (West Germany).
THE ORIENTATION OF Ca-ATOMS IN THE METASTABLE LEVELS 3d4s 1D2 AND 4s4p 3P1 BY SHOCKS WITH OPTICALLY PUMPED Na-ATOMS [DIE ORIENTIERUNG VON CA-ATOMEN IN DEN METASTABILEN ZUSTAENDEN 3D4S 1D2 UND 4S4P 3P1 DURCH STOESSE MIT OPTISCH GEPUMPTEN NA-ATOMEN]
Volkmar Troebs (Ph.D. Thesis) 1970 30 p refs In GERMAN
Avail: NTIS

Atomic shock-induced angular momentum exchanges were used to investigate spin exchanges in S levels of alkali atoms. An optical pumped atomic sodium beam was crossed by an atomic calcium beam so that the metastable calcium atoms in levels 3d4s 1D2 and 4s4p 3P1 were shock-oriented by the sodium atoms. High frequency transfers between Zeeman sublevels of metastable calcium atoms were used to determine orientation exchanges. Polarization measurements on oriented levels and approximated particle densities in absorption spectra found that the effective cross section for orientation exchange between optically pumped sodium atom at ground level 2S1/2 and calcium atoms at metastable levels 1D2 and 3P1 had the same order of magnitude as the effective spin exchange cross section between alkali atoms at ground levels. Transl. by G.G.

N71-15970# Oak Ridge National Lab., Tenn.
INELASTIC INTERACTIONS OF HIGH ENERGY PARTICLES WITH LIGHT NUCLEI
O. B. Abdinov et al 1970 11 p refs Transl. into ENGLISH of Russian report JINR-P2-5023
(ORNL-tr-2373; JINR-P2-5023) Avail: NTIS

The cascade-evaporation model of inelastic interactions of particles with nuclei is extended to light nuclei. Quantities characterizing the formation of clusters in the nucleus are established phenomenologically and subsequently determined by comparing the results of the calculations with experiment; only alpha-particle clusters are considered. The characteristics of elastic and inelastic interactions with alpha clusters are assumed to be the same as for interactions with free alpha particles, and the statistical theory of Fermi is used to calculate the probabilities of the various decay channels of the excited residual nuclei. Energy distributions, angular distributions, and cross sections are compared with the data. This cascade model can be used to calculate the splitting of light nuclei by high-energy particles. NSA

N71-15971# Maryland Univ., College Park. Dept. of Physics and Astronomy.
BROKEN SCALE INVARIANCE AND KINEMATIC MOMENTS OF ELECTROPRODUCTION CROSS SECTIONS
Robert Budny Sep. 1970 9 p refs Supported by AEC
(ORO-2504-159; TR-71-037) Avail: NTIS

Expressions for high-energy limits of electroproduction cross section are derived from a previous broken scale invariance scheme. Author (NSA)

N71-15972# Bonn Univ. (West Germany). Inst. fuer Physikalische Chemie.
DEPENDENCE OF THE BACKSCATTERING FACTOR OF ELECTRONS ON THE SURFACE ROUGHNESS OF METALS [DIE ABHAENGIGKEIT DES RUECKSTREUFAKTORS VON ELEKTRONEN VON DER OBERFLAECHENRAUHIGKEIT VON METALLEN]
F. Tautenhahn, W. Puetz, and L. von Erichsen Jul. 1970 54 p refs In GERMAN; ENGLISH summary
(BMBW-FBK-70-8-A) Avail: AEC Depository Libraries

The backscattering factor was investigated as a function of surface roughness of the carrier material of the radioactive nuclide for metals of different atomic numbers and beta emitters of different maximum energies. A sensitive dependence of the backscattering factor on the surface roughness of the metallic support was observed. For example, in the roughness range from 0 to 100 micron the backscattering factor decreased by 50% in the case of Ni-63. This effect decreased continuously with higher maximum beta-particle energies, and could not be observed at energies above 2 MeV. Author (NSA)

N71-18873*# Pittsburgh Univ., Pa. Space Research Coordination Center.

GAS PHASE REACTION RATES OF SOME POSITIVE IONS WITH WATER AT 296 K

Carleton J. Howard, Howard W. Rundle, and Frederick Kaufman 19 Oct. 1970 24 p refs Sponsored in part by the A. W. Mellon Educational and Charitable Trust, the Maurice Falk Med. Fund, the Richard King Mellon Found., and the Sarah Mellon Scaife Found.

(Grant NsG-416)

(NASA-CR-116142; SRCC-131) Avail: NTIS CSCL 20H

Measurements of the rate constants for the reactions of He(+), Ne(+), Ar(+), Kr(+), O(+), N(+), and N2(+) with H2O by the flowing afterglow technique at 296 K gave values of 0.56, 0.74, 1.43, 1.19, 2.33, 2.57, and 2.19 x 10 to the −9th power per ccm/sec with standard deviation of 7 to 15%. They are in good agreement with extrapolated beam results for Ar(+), O(+), N(+), and N2(+). Close agreement is also found for all but He(+) and Ne(+) with estimates based on classical trajectory calculations for similar ion plus dipole systems. Author

N71-18991*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

AUTOIONIZATION OF H2 NEAR THRESHOLD

F. H. M. Faisal Jan. 1971 16 p refs Submitted for publication

(NASA-TM-X-65434; X-641-71-3) Avail: NTIS CSCL 20H

Rates of autoionization of H2 near threshold is calculated within an internal conversion model. The results explicitly show the dependence rates for increasing principal quantum numbers and follow the socalled propensity rule for vibrational quanta involved. Unlike other theoretical calculations the present model provides a simple formula from which the rates may easily be calculated. Limitations and possible refinements of the model are discussed and generalizations for diatomic molecules other than H2, are indicated. Author

N71-18001# Argonne National Lab., Ill.

INTERNATIONAL COMPARISON OF Mn-56 ACTIVITY IN 1968

A. De Volpi, comp. Dec. 1969 34 p refs

(Contract W-31-109-ENG-38)

(ANL-7642) Avail: NTIS

The absolute radioassay of liquid samples of Mn-56 was carried out by six laboratories in Europe and North America in September 1968. Aside from frequent application in a variety of nuclear reactor irradiations, Mn-56 is the basic activity produced in the manganese bath system of neutron-source calibration, which in turn is directly connected with some determinations of the neutron yield from fission. Because of possible related discrepancies in nuclear data, a limited intercomparison was organized by the National Physical Laboratory of England. Although the 2.6-hr half-life places a premium on rapid transportation and processing, six laboratories were able to participate simultaneously. All participants calibrated aliquots of the samples through a coincidence technique. The range of values obtained was 0.6%, and the rms error was 0.1%. Despite the narrow range of results, a bias due to calibration technique is possible. Author (NSA)

N71-18002# Chicago Univ., Ill. Dept. of Physics.

DUAL RESONANCE MODEL WITH QUARK SPIN

Motohiko Yoshimura (Ph.D. Thesis) Aug. 1970 37 p refs

(Contract AT(11-1)-264)

(COO-264-557; EFI-70-45) Avail: NTIS

A dual resonance model with nontrivial quark spin factors is presented. An amplitude is found which satisfies factorization and eliminates the parity doubling ghosts. An application to pion pion elastic scattering indicates that the positivity condition is not met on the first daughter trajectory if one assumes realistic values for the mass and intercept. Author (NSA)

N71-18003# Los Alamos Scientific Lab., N.Mex.

CALCULATION OF LIGHT-PARTICLE ENERGY LOSS IN THICK FOILS

W. K. Brown and D. W. Watkins May 1970 7 p refs

(Contract W-7405-eng-36)

(LA-4443) Avail: NTIS

Results are presented of a computer calculation of the average energy loss of light particles in selected target foil materials which have high neutron cross sections. The listed FORTRAN program has sufficient flexibility to be of use in calculating the average total energy deposited in solid-state detectors from any light particle-producing-reaction and for any target material. The calculation serves as a useful check in the analysis of neutron flux measurements using underground nuclear explosions. Author (NSA)

N71-18010# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MAGNETIC FIELD HARMONIC ANALYZER FOR CYCLIC ACCELERATORS

V. N. Anosov et al 19 Aug. 1970 18 p refs Transl. into ENGLISH from the Russian Report

(AD-714767; FTD-MT-24-134-70) Avail: NTIS CSCL 20/7

The authors describe a specialized digital computer which reduces magnetic measurement data during the process of shaping the desired configuration of the magnetic field in cyclic accelerators and particularly in isochronous accelerators. It calculates the amplitude and phase of the harmonic series given by definite H-values at points uniformly distributed along the period. Particular values of the magnetic field distribution function are fed in at the computers six-digit decimal keyboard, translated into its 20-digit binary code, and fed into the magnetic internal storage. The computers harmonic analysis program and necessary constants are stored in a diode-type permanent storage with a total volume of 178 22-digit numbers. Sixteen various arithmetic and logical operations are required by the program of the chosen computation algorithm. Control pulse frequency of the arithmetic unit is 20 kHz. Harmonic analysis results are printed out by the EUM-46 DP electric printer at a rate of 5-6 decimal places per second. All computer units are based on semiconductors. Its dimensions are 160 x 180 x 50 cm and power consumption is 750-1000 w. Author (GRA)

N71-18011# California Univ., Berkeley. Lawrence Radiation Lab.

STRANGE PARTICLE PRODUCTION IN PI(+) PROTON INTERACTIONS NEAR 3.7 GeV/c

William Ralph Butler (Ph.D. Thesis) 29 May 1970 76 p refs

(Contract W-7405-eng-48)

(UCRL-19845) Avail: NTIS

Cross sections are presented for both stable and resonant strange particle final states produced by the interactions of positive pions in hydrogen. The data are taken from several incident momenta between 3.56 GeV/c and 3.82 GeV/c. The overall strange particle cross section is found to be 1.5 mb. Two favorable tests of line reversal are presented. Author (NSA)

N71-18012# Central Research Inst. for Physics, Budapest (Hungary).

NEUTRON AVERAGE ENERGIES: CALCULATIONS AND THEORY OF MEASUREMENTS

S. Makra [1970] 24 p refs

(KFKI-70-6) Avail: AEC Depository Libraries

The average energies of reactor neutrons penetrating through various shielding walls and theories of attenuation techniques (Block and Shon and paired Bonner-sphere techniques) are presented. A comparison was made of calculated and measured values. NSA

N71-16013# Bonn Univ. (West Germany). Inst. fuer Physikalische Chemie.
EXPERIMENTAL PROBLEMS OF BACKSCATTERING FACTOR DETERMINATION OF beta PARTICLES USING THE 2 pi-4 pi METHOD [EXPERIMENTELLE PROBLEME BEI DER BESTIMMUNG DES RUECKSTREUFAKTORS VON ELEKTRONEN NACH DER 2 pi-4 pi METHODE]
E. Tautenhahn, W. Puetz, and L. von Erichsen Jul. 1970 22 p refs In GERMAN; ENGLISH summary
(BMBW-FBK-70-8-B) Avail: AEC Depository Libraries

The production and gold layering in vacuo of extremely thin films for use as carrier foils in 4 pions-counting are described, and several methods for the determination of the thickness of film and gold layer, respectively, are pointed out. The sources of error leading to a falsification of the true 4 pions-disintegration rate are discussed. Author (NSA)

N71-16023# California Inst. of Tech., Pasadena.
STUDY OF K(+) p INELASTIC CHANNELS
B. Barish, R. Gomez, S. Loken, J. Pine, D. Davies (Calif. Univ., Los Angeles), et al. [1970] 12 p refs Presented at the 15th Intern. Conf. High Energy Phys., Kiev Supported in part by AEC Prepared jointly with Calif. Univ., Los Angeles and Natl. Accelerator Lab.
(CALT-68-274; Conf-700805-39) Avail: NTIS

Recent experiments have indicated the possible existence of a highly inelastic resonance in the P(3/2) partial wave in K(+)p scattering. A 400-K exposure was taken to study the momentum dependence of inelastic channels in the K(+)p system. The exposure consisted of seven K(+) momenta, equally spaced between 1.3 and 2.2 GeV/c. Partial cross sections are presented for final states corresponding to 4 prong and 2 prong + vee topologies. Author (NSA)

N71-16024# Stanford Linear Accelerator Center, Calif.
NEUTRAL PION AND ETA PHOTOPRODUCTION FROM HYDROGEN AT HIGH ENERGIES
James R. Johnson Sep. 1970 95 p refs
(Contract AT(04-3)-515)
(SLAC-124) Avail: NTIS

Measurements were made of the process photon proton yields pion(0) proton for photon energies from 4 to 18 GeV and four-momentum transfers t between −0.1 and −1.4 (GeV/c) squared. The reaction gamma p yields eta-meson p was studied between 4 and 9 GeV for t-values from −0.3 to −1.4 (GeV/c) squared. The experiment was carried out at the Stanford Linear Accelerator Center (SLAC) by passing the SLAC photon beam through a target containing gaseous hydrogen for small momentum transfers and liquid hydrogen for higher t-values. The recoil protons were analyzed and detected in the SLAC 1.6-GeV/c spectrometer, and the missing mass of the neutral product was calculated from kinematics. A simple t-channel exchange model cannot explain both processes with the same assumptions, even though the quantum numbers of the two mesons are the same except for isospin. Author (NSA)

N71-16053*# Virginia Polytechnic Inst., Blacksburg.
THE 5g YIELDS 4f PIONIC TRANSITION IN Th 232 AND U 238
D. A. Jenkins, R. J. Powers, and A. R. Kunselman (Wyoming Univ.) [1970] 16 p refs
(Grant NGL-47-004-006)
(NASA-CR-116140) Avail: NTIS CSCL 20H

Early measurements of pionic X-ray energies and widths in Th-232 and U-238 have suggested the possibility of an anomalous effect for the interaction between high Z nuclei and a pion in the 4f-atomic state. The 5g yields 4f X-ray energies and widths were remeasured in these isotopes and compared to a calculation which considers the distortion of the nucleus. A small disagreement between theory and experiment persists, but it is probably due to uncertainties in the calculation of the strong interaction effects. Author

N71-16054# Ceskoslovenska Akademie Ved, Rez. Ustav Jademneho Vyzkumu.
ON THE FULL EXPERIMENT IN WEAK SEMILEPTONIC HYPERON DECAYS
J. Dittrich and F. Janouch 1970 12 p refs
(UJV-2432-F) Avail: AEC Depository Libraries

An attempt is made to determine a set (or sets) of experiments which represents a full experiment for weak and semileptonic hyperon decays, assuming local current−current V−A Lagrangian. The discussion covers the main theoretical assumptions, the formulas, different variants for full experiments, and the procedure used for the determination of the unknown parameters. NSA

N71-16055# Stanford Linear Accelerator Center, Calif.
RECENT RESULTS IN INELASTIC ELECTRON SCATTERING
E. D. Bloom, G. Buschhorn, R. L. Cottrell, D. H. Coward, H. DeStaebler et al Sep. 1970 51 p refs Presented at the 15th Intern. Conf. on High Energy Phys., Kiev Prepared jointly with MIT, Cambridge
(Contract AT(30-1)-2098)
(SLAC-PUB-796; Conf-700806-40) Avail: NTIS

A status report is presented on various inelastic e + p experiments. Some preliminary results are included on inelastic e + p and e + d interactions. NSA

N71-16093*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
MOLECULAR COLLISIONS. 14: FIRST-ORDER APPROXIMATION OF THE GENERALIZED PHASE SHIFT TREATMENT OF ROTATIONAL EXCITATION: ATOM-RIGID ROTOR
M. D. Pattengill, C. F. Curtiss, and R. B. Bernstein 19 Oct. 1970 61 p refs
(Grants NGL-50-002-001; NSF GP-12832; NSF GB-16665)
(NASA-CR-116136; WIS-TCI-421) Avail: NTIS CSCL 20H

The generalized phase shift approach to the rotational excitation problem is applied to the atom-rigid rotor case in the lowest approximation. The treatment involves the computation of generalized action integrals over curved trajectories. Numerical results are presented to illustrate the dependence of the transition probabilities on the usual physical parameters, as well as a new parameter, zeta, which is proportional to the ratio of the moment of inertia of the van der Waals atom-diatom system to that of the diatomic rotor (and thus to the ratio of the collision time to the diatom rotation time). In the limit zeta approaches zero, the development reduces to the sudden approximation. In the large impact parameter limit (straight-line trajectories), the deviation from the sudden approximation is described by resonance functions identical to those obtained implicitly by Van Kranendonk. The numerical results are presented in a manner which illustrates the deviation from each of these two limits. Author

N71-16094# Aerospace Corp., El Segundo, Calif. Lab. Operations.
A COLLECTION OF COMPUTER PROGRAMS FOR MOLECULAR SPECTROSCOPY
Richard T. Hall 15 Sep. 1970 149 p refs
(Contract F04701-70-C-0059)
(AD-714560; TR-0059(9260-01)-8; SAMSO-TR-70-364) Avail: NTIS CSCL 7/4

A series of computer programs useful in deriving molecular rotational constants and energy levels from observed rotational spectra of asymmetric rotor molecules is presented. A routine to obtain combination difference relations from vibrational-rotational spectra that can be used in addition to the pure rotational transitions to determine a set of energy levels is included also. Author (GRA)

N71-16098* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ELECTROSTATIC CHARGED PARTICLE ANALYZER HAVING DEFLECTION MEMBERS SHAPED ACCORDING TO THE PERIODIC VOLTAGE APPLIED THERETO Patent

John Dimeff, inventor (to NASA) Issued 6 Oct. 1970 (Filed 30 Jan. 1968) 7 p Cl. 250-41.9; Int. Cl. H01j39/34
(NASA-Case-XAC-05506-1; US-Patent-3,532,880; US-Patent-Appl-SN-701732) Avail: US Patent Office CSCL 20H

A charged particle analyzer is described in which a periodically varying voltage is applied across electrostatic deflection members. The deflection members have opposed surfaces defining a passageway for charged particles to be analyzed and these surfaces are shaped for establishing the direction of the electric field in the passageway perpendicular to the trajectory of the particles throughout the entire length of the passageway. Under these conditions, only those particles simultaneously characterized by a given velocity and a given energy-to-charge ratio can pass through the deflection members without interception. Official Gazette of the U.S. Patent Office

N71-16188# Rochester Univ., N.Y. Dept. of Physics and Astronomy.

STATISTICAL PROPERTIES OF ELECTROMAGNETIC RADIATION Final Report, 1 Aug. 1967–31 Jul. 1970

Emil Wolf Sep. 1970 23 p refs
(Grant DA-ARO(D)-31-124-G918-51)
(AD-714685; AROD-4965-55P) Avail: NTIS CSCL 20/14

The documents chiefly concerned the following topics: Theory of photoelectron detection of light fluctuations, coherence properties of optical fields, correlation tensors of blackbody radiation, phase space calculus for the study of quantum mechanical systems, superradiant emission, the role of evanescent waves in fields generated by moving charged particles and various non-linear phenomena such as parametric amplification, parametric frequency conversion, Raman and Brillouin scattering, second harmonic generation and optical interaction in non-linear media. Author (GRA)

N71-16191# Oak Ridge National Lab., Tenn. Office of Language Services.

ORPHEE 6 PROGRAM: ATTENUATION OF FAST NEUTRONS IN A STRUCTURE CONSISTING OF LAYERS OF WATER AND DENSE MATERIAL

Michel Simon Oct. 1970 20 p ref Transl. into ENGLISH of CEA, Fontenay-aux-Roses, France, report CEA-N-1244
(ORNL-tr-2357; CEA-N-1244) Avail: NTIS

The program ORPHEE VI deals with the attenuation of fast neutrons in a succession of heavy media separated by thin layers of water in a cylindrical geometry. The description of the sources by bundles renders it particularly suited to light water power reactors. It is distinguished by two peculiarities: the attenuation in the water is treated according to the formalism of the nucleus in water which is different from the straight-line attenuation used for dense materials; and it offers the possibility of taking into account the position of the control rods for the calculation of the fast neutron flux. The program is written in FORTRAN IV for the IBM 360. Author (NSA)

N71-16194# Purdue Univ., Lafayette, Ind. Nuclear Structure Lab.

EXPERIMENTAL TEST OF THE KUMAR-BARANGER PAIRING-PLUS-QUADRUPOLE FORCE MODEL IN THE A = 190 REGION THROUGH E2/M1 MIXING AMPLITUDES

K. S. Krane and R. M. Steffen [1970] 26 p refs
(Contract AT(11-1)-1748)
(COO-1748-47) Avail: NTIS

The E2/M1 multipole mixing ratios delta (gamma) of gamma transitions in even-even osmium and platinum isotopes have been measured in order to test the predictions of the pairing-plus-quadrupole theory of Kumar and Baranger. The mixing ratios delta (gamma) were determined from direction correlation measurements of gamma transitions in Os-186,188,190 (populated in the decay of Ir-186,188,190) and in Pt-194,196 (populated in the decay of Au-194,196). The radioactive iridium isotopes were produced by Re(alpha,xn) reactions and the gold isotopes were produced by Pt(d,xn) reactions. Except for the 333 keV transition in Pt-196 the agreement of the experimental mixing ratios with the values and signs predicted by the Kumar-Baranger model is excellent. Author (NSA)

N71-16195# Bettis Atomic Power Lab., Pittsburgh, Pa.

BUBL-1: A STATISTICAL FUEL SWELLING AND FISSION GAS RELEASE MODEL (LWBR DEVELOPMENT PROGRAM)

H. R. Warner Sep. 1970 85 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-942) Avail: NTIS

A computer simulation of a fuel region has been developed based on movement of fission-gas bubbles in solids under a thermal gradient. Within this region, fission gas events are followed via a Monte Carlo technique. Individual bubbles are followed through their time history from nucleation to release from the fuel, with interactions at dislocations and grain boundaries. Saturation in gaseous swelling at elevated temperature is predicted. A maximum in swelling is predicted at intermediate temperatures for a given burnup. These swelling and gas release predictions at high temperatures are in good agreement with experimental results. Author (NSA)

N71-16196# Iowa State Univ. of Science and Technology, Ames.

LIFETIMES OF THE FIRST EXCITED STATES IN Tm-169, Tm-171, AND Ce-134

Charles Edward Turner, Jr. (Ph.D. Thesis) Aug. 1970 163 p refs
(Contract W-7405-eng-82)
(IS-T-350) Avail: NTIS

A careful experimental investigation was carried out in order to provide values of convincing accuracy for the lifetimes of the 8.4-keV level in Tm-169 and the 5.0-keV level in Tm-171 in view of existing experimental discrepancies. The objective was to determine whether or not the general disagreement with the rotational model predictions for these lifetimes could be removed. The half-life values determined by delayed-coincidence measurements utilizing magnetic energy discrimination and electrostatic preacceleration techniques were found to be (4.04 + or − 0.06) nsec and (4.77 + or − 0.06) nsec for the 8.4-keV level in Tm-169 and the 5.0-keV level in Tm-171, respectively. These values are in good agreement with the predictions of the rotational model for the lifetime of a first-excited rotational state. Indications of a systematic discrepancy with earlier measurements in Tm-169 and Tm-171 led to remeasurement by similar techniques of the half-life of the 11-keV level in Ce-134. The result of (45.7 + or − 1.2) nsec reinforced the evidence for a systematic discrepancy. Author (NSA)

N71-16197# Naval Research Lab., Washington, D.C.

NRL VAN de GRAAFF OPERATION, 1 JANUARY - 30 JUNE

1970
K. L. Dunning Aug. 1970 33 p
(AD-714141; NRL-MR-2173) Avail: NTIS CSCL 20/7

The report is the fifth of a series of semiannual summaries on the use of the 5-MV Van de Graaff accelerator and associated instruments. The period 1 January 1970 to 30 June 1970 is covered. A brief statistical summary is presented, a few important developments concerning the maintenance and improvement of apparatus are discussed, and brief accounts of on-going and recently completed research projects are given. Author (GRA)

N71-16202# Paris Univ., Orsay (France). Faculte des Sciences.
STUDY OF NUCLEON TRANSFER REACTIONS BETWEEN HEAVY IONS
Michel Liu (Ph.D. Thesis) 1970 65 p refs In FRENCH
(NP-18448) Avail: AEC Depository Libraries

The angular distributions of particular transfer reactions at various incident energies were studied. The reactions B-11(N-14,C-13)C-12 and B-11(N-14,O-15)Be-10 were studied at 40, 77 and 113 MeV. The reactions C-12(N-14,N-13)C-13 and C-12(N-14,C-13)N-13 were studied at 77 MeV, and the reactions C-13(C-12,C-13)C-12 and B-11(C-12,B-11)C-12 at 87 MeV. The results obtained were explained to describe the reaction mechanisms. The validities of the different approximations proposed for calculating the differential cross sections of the interaction models were compared. NSA

N71-16203# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
TACHYONS: POSSIBLE PARTICLES WITH GREATER-THAN-LIGHT VELOCITY
R. Bafico 23 Feb. 1970 23 p refs In ITALIAN
(RT/FI-(70)13) Avail: AEC Depository Libraries

Various problems raised by the hypothesis of faster than light particles are studied. In particular the causal puzzles are discussed which, at first sight, arise and how to solve them. The difficulties encountered in a field theory for such particles are also discussed. Author (NSA)

N71-16213# National Aeronautics and Space Administration. Goodard Space Flight Center, Greenbelt, Md.
DUST PARTICLE INJECTOR FOR HYPERVELOCITY ACCELERATORS Patent
Otto E. Berg, inventor (to NASA) Issued 28 Apr. 1970 (Filed 31 Aug. 1967) 5 p Cl. 315-111; Int. Cl. H01j29/56, 33/02
(NASA-Case-XGS-06628; US-Patent-3,509,419; US-Patent-Appl-SN-665680) Avail: US Patent Office CSCL 20G

A method and apparatus are described for use in forming a highly collimated beam of microparticles having a high charge-to-mass ratio and injecting the beam into an electrostatic accelerating tube. The apparatus includes an insulated housing having a particle exit opening; a pair of conically shaped electrodes which are arranged within the housing with their apex portions in a facing relationship in alignment with the housing exit opening, the electrode adjacent to the housing exit opening having a particle exit passageway extending through the apex portion; and an electrical circuit adapted to control charging of the particles and the application of an electrical field across the electrodes. Particles arranged within the housing are electrostatically charged to distribute the particles adjacent to the electrodes, where voltage pulses of appropriate sign are applied to produce a strongly collimated beam of charted particles having a high charge-to-mass ratio. The beam is ejected from the housing through the electrode passageway and housing exit opening, and then injected into an electrostatic accelerating tube. Official Gazette of the U.S. Patent Office

N71-16241# California Univ., Berkeley. Lawrence Radiation Lab.
THE THEORETICAL ANALYSIS OF NUCLEAR REACTIONS INVOLVING STRONGLY DEFORMED NUCLEI USING PHENOMENOLOGICAL MODELS
Raymond Stuart Mackintosh (Ph.D. Thesis) Mar. 1970 259 p refs
(Contract W-7405-eng-48)
(UCRL-19529) Avail: NTIS

Stripping reactions, A(d,p) A + 1, are studied for the case where A is a strongly deformed nucleus. The possibility that the projectiles d and p can set the nucleus in rotational motion is considered. The importance of these inelastic processes using the coupled-channel source-term technique of Ascuitto and Glendenning is studied. This is shown to be equivalent to the coupled-channel Born approximation written down by Penny and Satchler. A formal derivation of DWBA given by Greider and Dodd is generalized. For A about 25 and for 10- and 12-MeV deuterons, inelastic processes are of vital importance relative strengths of levels may be greatly changed by their inclusion, and angular distributions may be significantly improved, although the detailed shape is still not reproduced for these light nuclei. For 12-MeV deuterons in the deformed rare earth region, the inclusion of inelastic processes will, in general, lead to substantial differences in values, extracted by comparison with experiment, of the amplitudes with which particular angular momenta occur in the various Nilsson states. Author (NSA)

N71-16242# Democritus Nuclear Research Center, Athens (Greece).
INFINITE MULTIPLETS WITH SU(3)
E. Kyriakopoulos May 1970 23 p refs
(DEMO-70/14) Avail: AEC Depository Libraries

An infinite multiplet model for mesons containing SU(3) was constructed. The model is based on the mapping of the group SU(3)/Z3 into SO(8), and on the fact that the n-dimensional spherical harmonics can be accommodated into a single irreducible representation of the group SO(n,2). In this relativistic SU(6) type scheme only SU(3) representations of triality zero appear. An infinite component wave equation is given. Author (NSA)

N71-16243# Atomic Energy Commission Research Establishment, Riso (Denmark).
STUDIES IN NEUTRON PHYSICS. 1: THERMAL NEUTRON BEAM STANDARDIZATION BY MEANS OF THE He-3(n,p)T REACTION. 2: THE ORDER-DISORDER TRANSITION IN BETA-BRASS STUDIED BY NEUTRON DIFFRACTION
J. Als-Nielsen (Ph.D. Thesis - Copenhagen Univ.) Apr. 1969 83 p refs
(RISO-196) Avail: AEC Depository Libraries

A series of experimental investigations in nuclear physics and solid state physics utilizing thermal neutrons from the DR 3 reactor at Risoe is reviewed. The nuclear physics experiments concern a method employing the He-3(n,p)T reaction for stnadardization of thermal neutron beams. These experiments made up some of the thermal investigations necessary for the recently completed measurement of the free neutron half life. The solid state physics experiment deals with the study of order-disorder transition in beta-brass by neutron diffraction techniques. These experiments were carried out for comparison with modern theories of critical phenomena accompanying second-order phase transitions. Author (NSA)

N71-16244# Catholic Univ. of America, Washington, D.C. Dept. of Nuclear Science and Engineering.
EXPERIMENTAL AND THEORETICAL INVESTIGATION OF NUCLEAR FISSION INDUCED BY LOW-ENERGY NUCLEAR PARTICLES Progress Report

R. W. Deutsch 1 Feb. 1970 14 p refs
(Contract AT(40-1)-3951)
(TID-25351) Avail: NTIS

An experimental program to measure the excitation functions and half lives of spontaneous fission emitters has been started, using the 15-MeV Tandem Van de Graaff facility. The experimental arrangement to be used for these measurements has been thoroughly reviewed and the necessary electronic equipment has been ordered. The remainder of the contract period will be concerned with collimation, alignment and electronics check-out problems, prior to carrying out measurements of protons and deuterons incident on U-238, U-239, Pu-240, and Pu-241. The analysis of fission fragment characteristics resulting from thermal neutron fission of U-233, U-235, and Pu-239 was completed. Similar analysis is being carried out as a function of neutron energy for U-235, using improved theoretical models. Author (NSA)

N71-16245# Tennessee Univ., Knoxville.
REALISTIC INTERACTIONS AND EXCHANGE EFFECTS IN MICROSCOPIC DESCRIPTIONS OF ELASTIC AND INELASTIC NUCLEON SCATTERING
Larry Wayne Owen (Ph.D. Thesis) Aug. 1970 145 p refs
Supported by AEC and Oak Ridge Assoc. Univ.
(TID-25504) Avail: NTIS

The effects of exchange in microscopic descriptions of elastic and inelastic nucleon-nucleus scattering using realistic nucleon – nucleon effective interactions were investigated. The interaction in even states of relative motion is taken to be the long-range part of the Hamada – Johnston potential. Possible effects upon the elastic scattering of a central interaction in singlet-odd states are investigated. The spin-orbit optical potential is calculated using two estimates for the nucleon – nucleon spin-orbit interaction in triplet-odd states. The microscopic model of the real part of the optical potential consists of a direct term which is local, and an exchange term which is nonlocal and different for each partial wave. The ground state wave functions of the target nuclei are assumed to be given by the independent particle model. Oscillator, Woods – Saxon, and Hartree – Fock single-particle functions are used. The scattering induced by these nonlocal potentials is obtained exactly by explicitly solving the integro-differential Schroedinger equations. Author (NSA)

N71-16246# Cornell Univ., Ithaca, N.Y. Lab. of Nuclear Studies.
QUANTUM ELECTRODYNAMIC THEORY: ITS RELATION TO PRECISION LOW ENERGY EXPERIMENTS
Stanley J. Brodsky Aug. 1970 33 p refs Presented at the Intern. Conf. on Precision Meas. and Fundamental Constants, Gaithersburg, Md., 5-7 Aug. 1970 Sponsored in part by AEC and NSF Prepared in cooperation with Stanford Linear Accelerator Center
(SLAC-PUB-795) Avail: NTIS

Recent developments in the precision tests of quantum electrodynamics are reviewed. These tests are the anomalous magnetic moments and the Lamb shift and fine structure of hydrogenic atoms. NSA

N71-16247# Scientific Control Systems, Ltd., Washington, D.C.
THE FOURTH PHASE OF RESEARCH ON ATOMIC STRUCTURES Final Report
D. F. Meyers and F. O'Brien Wright-Patterson AFB, Ohio ARL Jul. 1970 176 p refs
(Contract F33615-67-C-1786)
(AD-714073; ARL-70-0112) Avail: NTIS CSCL 7/4

A program for solving the mixed relativistic and non-relativistic and non-relativistic form of the Hartree-Fock equations is discussed in detail, based on the relativistic program described under a previous contract. A program for generating continuum wave functions, in a form suitable for use with the Hartree-Fock programs previously written, is also discussed, and a complete run of the program system included. Program listings are included for the mixed relativistic and non-relativistic program. Author (GRA)

N71-16248# Oak Ridge National Lab., Tenn.
TABLE OF MAGNETIC HYPERFINE-STRUCTURE ANOMALIES
G. H. Fuller and V. W. Cohen Sep. 1970 27 p refs
(Contract W-7405-eng-26)
(ORNL-4591) Avail: NTIS

A table of magnetic hyperfine-structure anomalies calculated from measured moment ratios is presented. The measured nuclear g ratios and ratios of both magnetic and electric hyperfine interaction constants are included. References to the original papers are given for the ratios listed, along with a code letter which indicates the experimental methods used. Author (NSA)

N71-16249# Purdue Univ., Lafayette, Ind.
GAMMA-GAMMA DIRECTIONAL CORRELATION MEASUREMENTS IN Te 124
Z. W. Grabowski, K. S. Krane, and R. M. Steffen 1970 5 p refs Presented at Conf. on Angular Correlations in Nucl. Disintegration, Delft, The Netherlands Sponsored by AEC
(COO-1746-40; CONF-700807-3) Avail: NTIS

The 723gamma – 603gamma directional correlation was measured using a combination of coaxial Ge(Li) – NaI(Tl) and and two coaxial Ge(Li) detectors. The coincidence rate was determined at seven angles and corrected for chance coincidences, coincidences caused by competing cascades, and the finite solid angle of the detectors. The energy resolution of the Ge(Li) detectors was better than 3.5 keV. The weighted average for the E2/M1 mixing ratio obtained from these measurements is delta sub 723 = −3.4 + or − 0.1, and thus the K-conversion coefficient for the 723-keV transition in Te-124 is alpha sub k(723) = 0.0027. The 646gamma – 603gamma, 1691gamma – 603gamma, and 2091gamma – 603gamma directional correlations in Te-124 were also measured. The spin I = 4 assignment is made for the 1249-keV level. The 2294- and 2694-keV levels are assigned the spin 3(−), with the 1691- and 2091-keV transitions being essentially pure E1. NSA

N71-16250# California Univ., Livermore. Lawrence Radiation Lab.
CALCULATIONS OF THE TRANSPORT OF NEUTRONS FROM A (d,t) SOURCE THROUGH MANY MEAN FREE PATHS IN LIQUID NITROGEN
G. D. Sauter and P. A. Robinson 17 Apr. 1970 21 p refs
Sponsored by AEC
(UCRL-50856) Avail: NTIS

Calculations were made of neutron transport through liquid nitrogen, with the (d,t) source and the neutron detector both located in the liquid nitrogen. The detector-output pulse height spectra expected for various source-detector distances were calculated by a Monte Carlo technique, using two different libraries (i.e., sets) of nitrogen cross sections representing limit values. Comparisons of the calculated spectra with measured spectra show that the shapes are nearly identical. However, the magnitudes differ (by about 50% at 10 mean free paths for 14-MeV neutrons) depending on which cross section library is used. The neutron fluences at various distances from a point (d,t) source in an infinite medium of liquid nitrogen have also been calculated using the same libraries. Plots of the variation of these fluences with distance from the source for the various neutron-energy groups and with neutron energy for certain distances are presented. Author (NSA)

N71-16257# Union Carbide Corp., Oak Ridge, Tenn. Computing Technology Center.
REACTION MECHANISM STUDIES OF SINGLE AND DOUBLE DIFFERENTIAL CROSS SECTIONS FROM THE REACTION Mg-24(ALPHA, ALPHA', GAMMA)Mg-24
Gregory Scott McNeilly (Ph.D. Thesis – Fla. State Univ.) 7 Sep. 1970 135 p refs
(Contract W-7405-eng-26)
(CTC-43) Avail: NTIS

Alpha-gamma angular correlations (double differential cross sections(DDCS)) from the reaction Mg-24(alpha, alpha', gamma)Mg-24 were measured at an incident alpha particle energy of 16.65 MeV. An 800-keV thick target provided energy-averaged results. The scattered alpha particles were detected (in the horizontal plane) at 7.5 degree steps from 27.5 deg to 140 deg in the laboratory frame of reference. The gamma detector (also in the horizontal plane) was moved through 15 detector positions, thus measuring 15 points defining an alpha-gamma angular correlation for each particle angle, from which DDCS parameters were extracted. The DDCS data, together with available single differential cross section (SDCS) data from the ground state, the 1.37 MeV state, and the 4.12 MeV state of Mg-24, were analyzed. Theoretical fits to these data were calculated using a DWBA plus Hauser–Feshbach (HF) method, and a coupled-channels (CC) plus HF method. The inelastic levels in Mg-24 were treated as rotational excitations of a deformed nucleus. Author (NSA)

N71-16258# Los Alamos Scientific Lab., N.Mex.
PHOTOFISSION OF Th 232, U 238, Pu 238, Pu 240, AND Pu 242 AND STRUCTURE OF THE FISSION BARRIER
N. S. Rabotnov et al Jul. 1970 16 p refs Transl. into ENGLISH from Russian report Sponsored by AEC
(LA-4385-TR) Avail: NTIS

Measurements of the angular distributions and fragment yields for photofission of the even-even nuclei Th-232, U-238, Pu-238, Pu-240, and Pu-242 near the threshold are reported. Measurements were made in a beam of bremsstrahlung gamma quanta in a 12-MeV microtron in the region of maximum energies from 5 to 10 MeV. Calculation of the bremsstrahlung spectrum from a 1-mm tungsten target used to reduce the dependence of the total photofission cross section and its angular components on the energy of the gamma quanta is described. The results, which do not fit traditional concepts, indicate the existence of a double-humped fission barrier. Author (NSA)

N71-16266# Brookhaven National Lab., Upton, N.Y.
HALF-LIVES OF H 3 AND Pu 238
R. Sher Apr. 1970 5 p refs Sponsored by AEC
(BNL-50233) Avail: NTIS

The available measurements of the half-lives of tritium (H-3) and plutonium-238 are reviewed. Only recent values with relatively high precision are considered . Earlier measurements with large stated uncertainties are ignored. Final recommendations are listed. Author (NSA)

N71-16267# California Univ., Santa Barbara. Dept. of Physics.
ULTRAVIOLET ABSORPTION SPECTRA OF TRANSITION METAL ATOMS IN RARE-GAS MATRICES
David Mark Mass 18 Aug. 1970 125 p refs Sponsored in part by AFRPL
(Contract N00014-69-A-0200-8004; Arpa Order 125)
(AD-714726; TR-30) Avail: NTIS CSCL 7/4

Absorption spectra were obtained of chromium, manganese, iron, cobalt, copper, nickel, tin and palladium atoms trapped in argon matrices at 4.2 K and of iron and copper in krypton and xenon matrices at 4.2 and 20 K. These spectra were studied in the region from 2200 and 4000 A. The observed transitions were found to correlate with gas phase transitions of the atoms, under the assumption of a matrix and atomic configuration dependent shift of the atomic transitions from the gas phase. Energy shifts of the transitions were inversely proportional to matrix atom size. Atom diffusion and resultant aggregation within the matrix both during the condensation of the solid from the gas phase and during warming was found to be a significant effect. Oscillator strengths calculated from the observed spectra were 10 to 100 times less than gas phase values indicating considerable diffusion during deposition. Author (GRA)

N71-16268# Stanford Univ., Calif. High Energy Physics Lab.
HIGH ENERGY ELECTRON SCATTERING FROM LI-6
G. C. Li, I. Sick, R. R. Whitney, and M. R. Yearian Jul. 1970 25 p refs Sponsored in part by NSF
(Contract Nonr-225(67))
(AD-714022; HEPL-636) Avail: NTIS CSCL 20/8

Elastic electron scattering cross sections have been measured for 6Li at 500 MeV and values of q sup 2, the momentum transfer squared, up to 13 f(m sup (-2)). Calculations including nucleon-nucleon correlations predict a diffraction minimum beyond the range of previous measurements for 6Li. The results for 6Li do show a diffraction minimum at q sup 2 = 8 f(m sup (-2)); they are also compared with a phase shift calculation using an empirical charge distribution. Author (GRA)

N71-16269# Northwestern Univ., Evanston, Ill. Dept. of Chemistry.
ENERGY TRANSFER IN HOT MOLECULES Final Report, 1 Jun. 1966 – 31 Jul. 1970
E. W. Schlag Oct. 1970 11 p refs
(Grant AF-AFOSR-1615-68)
(AD-714100; AFOSR-70-2522TR) Avail: NTIS CSCL 7/4

Lifetimes of excited states can be determined not only at high pressures, but also at low pressures. The former gives but a single value for the electronic state, whereas th latter gives a different answer for as many vibrational substates of the electronic state as can be excited by absorption of light. This new method, termed vibronic lifetime spectroscopy, has been successfully demonstrated for beta-naphthylamine. Such measurements are a direct test for dynamic theories for photochemical intermediate states. Author (GRA)

N71-16293# Atomics International, Canoga Park, Calif.
UNIFIED MODEL FOR ANALYSIS OF COMPOUND NUCLEUS REACTIONS
C. L. Dunford 15 Jul. 1970 28 p refs
(Contract AT(04-3)-701)
(AI-AEC-12931) Avail: NTIS

The analysis of fast neutron cross sections are hampered by a lack of a unified model for calculations. This document presents a unified model of compound nucleus reactions which will allow a consistent calculation of compound nucleus reactions of interest to the cross section evaluator. The remaining direct reaction cross sections may be calculated by an optical model code which also provides the necessary input compound nucleus formation probabilities for the reaction cross section calculations. The results are useful for understanding the energy behavior of fast neutron cross sections and as an aid to the production of evaluated cross-section data in regions where no experimental data exist. Author (NSA)

N71-16297# Arkansas Univ., Fayetteville. Dept. of Chemistry.
NUCLEAR AND COSMOCHEMISTRY Annual Progress Report, 1 Aug. 1969 – 31 Jul. 1970

P. K. Kuroda 31 Jul. 1970 21 p refs
(Contract AT(40-1)-3235)
(ORO-3235-55) Avail: NTIS

Research progress in nuclear and cosmochemistry from August 1, 1969 to July 31, 1970 is reported. NSA

N71-16300# Cleveland State Univ., Ohio.
[RELATIVISTIC CLASSICAL THEORY PERTAINING TO ELEMENTARY PARTICLES] Final Report, Oct. 1968 – Sep. 1970
Herbert C. Corben 30 Sep. 1970 7 p
(Contract N00014-68-C-0065)
(AD-713896) Avail: NTIS CSCL 20/10

The report discusses work under the contract in the following areas: Strictly localizable field theories with rising trajectories; Classical relativistic rotator as a basis for the elementary particles; On the classical origin of Dirac-like wave equations; Space-like motions with speeds less than that of light; and A relativistic classical theory of pulsars. GRA

N71-16301# Oak Ridge National Lab., Tenn. Neutron Physics Div.
06R-D, A DISCRETE SCATTERING VERSION OF 06R WITH IMPORTANCE SAMPLING OF THE ANGLE OF SCATTER
C. E. Burgart 13 Aug. 1970 40 p refs Sponsored in part by AEC and DASA
(ORNL-TM-3031) Avail: NTIS

Discrete angle scattering, angular importance sampling, and angular-dependent path-length stretching have been incorporated into 06R, a Monte Carlo neutron transport code. A description is included of the modifications and additions to 06R and NUSECT, the cross-section preparation code. A brief description of the methods of importance sampling is presented in the context of 06R-D. An example of a method of preparation of importance sampling parameters is also presented. Author (NSA)

N71-16306# Oak Ridge National Lab., Tenn.
Al NEUTRON ELASTIC- AND INELASTIC-SCATTERING CROSS SECTIONS FROM 4.19 TO 8.56 MeV
W. E. Kinney and F. G. Perey Oct. 1970 72 p refs
(Contract W-7405-eng-26)
(ORNL-4516) Avail: NTIS

Numerical values of Al neutron elastic and inelastic scattering cross sections in the incident neutron energy range of 4.19 to 8.56 MeV are presented. The data are compared with the results of others and found to be consistent with them. The ENDF/B Al elastic angular distributions are in good agreement with experiments at angles less than 60 deg but are in poor agreement at angles larger than this. The ENDF/B Al inelastic excitation functions could be improved and extended through the use of data which has become available since the evaluation. Author (NSA)

N71-16307# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Nuclear Science.
A keV NEUTRON CAPTURE AND TRANSMISSION MEASUREMENTS ON Cr 50, Cr 52, Cr 53, Cr 54, Ni 60, AND V
R. G. Stieglitz, R. W. Hockenbury, and R. C. Block 1970 76 p refs
(Contract AT(30-1)-328)
(RPI-328-199) Avail: NTIS

Neutron capture and transmission measurements were performed on vanadium and enriched samples of Ni-60, Cr-50, Cr-52, Cr-53 and Cr-54 with an experimental resolution of 0.6 nanoseconds per meter. The capture measurements cover the energy range 0.1 to 200 keV, while the transmission measurements extend to over 300 keV. Parameters are extracted for both s-wave and p-wave resonances. S-wave and p-wave strength functions, potential scattering radii, average capture cross sections and resonance absorption integrals are determined. The radiation width is found to vary widely among the s-wave resonances of each nuclide. Author (NSA)

N71-16308# Los Alamos Scientific Lab., N.Mex.
ANDY1G2 AND ANDY1R2: MONTE CARLO PROGRAMS FOR TIME-DEPENDENT MONOENERGETIC PARTICLE TRANSPORT IN GENERAL GEOMETRIES AND REPEATING ARRAYS
D. R. Harris Jun. 1970 14 p refs
(Contract W-7405-eng-36)
(LA-4410) Avail: NTIS

The ANDY1G2 and ANDY1R2 programs in FORTRAN 4 for the CDC 6600 compute time-dependent, monoenergetic particle transport are described in, respectively, general geometries without repeating arrays, and general geometries with repeating arrays. In the latter case, moments of spatial distributions of collisions are computed at option. Particle emission from collisions is isotropic in the laboratory coordinate system and can be delayed. Author (NSA)

N71-16310# Notre Dame Univ., Ind.
[HIGH-RESOLUTION SPECTRA OF RADIOISOTOPES] Technical Progress Report, 1 Dec. 1969 – 30 Nov. 1970
John W. Mihelich Nov. 1970 8 p refs
(Contract AT(11-1)-498)
(COO-498-82) Avail: NTIS

Progress is briefly summarized for an experimental program to obtain high-resolution spectra of radioisotopes using reactor or accelerator produced sources and Coulomb excitation by O-18 beam. The program involves single and coincidence spectra, directional correlation measurements, determination of nuclear level half-lives, and Coulomb excitation. NSA

N71-16397# California Univ., Livermore. Lawrence Radiation Lab.
THRESHOLD PHOTONEUTRON CROSS SECTIONS FOR MEDIUM AND HEAVY NUCLEI
Robert J. Baglan (Ph.D. Thesis – Calif. Univ., Berkeley) 25 Aug. 1970 144 p refs Sponsored by AEC
(UCRL-50902) Avail: NTIS

The following (gamma,n) cross sections were measured with very high resolution in the energy range from threshold to approximately 1 MeV above the threshold: Mg-25, Cr-52,53, Fe-56,57, and Pb-206,207,208. Many individual compound nucleus resonances were resolved and area-analyzed. In addition, the cross sections were investigated for the occurrence of three distinct nuclear phenomenon: nonresonant neutron capture, doorway states, and analog states. Nonresonant neutron capture cross sections of 0.5 mb/sr for Pb-207 and .0042 mb/sr for Fe-56 were determined by measuring the asymmetry of resonances. In Pb-207, additional evidence, in the form of an envelope of gamma ray widths, was found for the previously reported positive 1/2 doorway state at 500 keV. A correlation analysis for the gamma ray and neutron widths of the fine structure of the doorway state determined its ground state gamma ray width to be 36.5 eV. Evidence was found for a positive 3/2 doorway state near 125 keV in Pb-207. The analogs of the ground and first excited states of Na-25 were seen in Mg-25. Five analog states of Mn-56 may have been excited in Fe-56. Author (NSA)

N71-16404# Edsel B. Ford Inst. For Medical Research, Detroit, Mich. Div. of Nuclear Spectroscopy and Radiation Physics.
A COMPILATION OF BETA EXCITED X-RAY SPECTRA. PART 3: C 14, H3, S35, Sr89, Tc99, W185, Kr85
Luther E. Preuss, C. Artman, and C. Bugenis Jun. 1970 391 p refs
(Contract AT(11-1)-1593)
(TID-22361-Pt-3) Avail: NTIS

Graphs of the excited X-ray spectra are presented for each isotope. The alphabetical listing of each isotope spectra by target element, source index according to target Z number, source preparation data, and catalog of spectra are given. Variation in format due to characteristics of individual isotopes and changes in instrumentation are described. N.E.N.

N71-16407# California Univ., Berkeley. Lawrence Radiation Lab. Inorganic Materials Research Div.
FAR INFRARED STUDIES OF SOLIDS. 1: ELECTRONIC LEVELS OF d1 IONS IN Al2O3. 2: PHONON CONTRIBUTION TO ELECTROMAGNETIC ABSORPTION IN LEAD
Richard Ross Joyce (Ph.D. Thesis) Aug. 1970 119 p refs
(Contract W-7405-eng-48)
(UCRL-19666) Avail: NTIS

Far-infrared spectroscopic techniques are used to study the low-lying electronic levels of impurity ions in Al2O3 and the electromagnetic absorptivity of Pb. The transmission spectra of Al2O3 doped with Ti, V, and Cr are measured in applied magnetic fields up to 55 koe. The behavior of absorption lines due to the ions Ti(3+) and V(4+) is discussed in terms of a theoretical description of the energy levels of a single d electron in the Al2O3 crystalline field modified by a dynamic Jahn-Teller effect. An absorption line attributed to V(3+) shows magnetic field behavior consistent with a spin Hamiltonian formulation, and the spin Hamiltonian parameters are directly obtained from the spectra. The low-temperature measurements of the absorptivity of superconducting and normal Pb show an onset of absorption when the photon energy is large enough to excite appreciable numbers of acoustic phonons. Author (NSA)

N71-16408# California Univ., Berkeley. Lawrence Radiation Lab.
ROTATIONAL PERTURBATIONS AND LOW-LYING ELECTRONIC STATES OF CaO
Helen Johansen (Ph.D. Thesis) Aug. 1970 108 p refs
(Contract W-7405-eng-48)
(UCRL-19649) Avail: NTIS

Sixteen bands of the A1 sigma to X(1) sigma transition of CaO-18 were analyzed, and the spectroscopic constants are given. Thirty-seven perturbations due to six electronic states or substates were found in the upper state. A comparison of these perturbations with those found in CaO-16 indicates that four of these perturbing states lie below the X(1) sigma, one is at 8080/cm, and one is the X(1) sigma state. Author (NSA)

N71-16421# Virginia Polytechnic Inst., Blacksburg. Dept. of Chemistry.
REACTIONS OF CHARGED AND NEUTRAL RECOIL PARTICLES FOLLOWING NUCLEAR TRANSFORMATIONS Progress Report
Hans J. Ache Sep. 1970 6 p refs
(Contract AT(40-1)-3602)
(ORO-3602-11; PR-4) Avail: NTIS

Research on the reactions of energetic particles generated in nuclear reactions and on positron annihilation and positronium chemistry are briefly summarized. A bibliography of reports published during the period is included. N.E.N.

N71-16482# California Univ., Santa Barbara. Dept. of Physics.
QUANTITATIVE STUDIES BY OPTICAL SPECTROSCOPY OF ENERGY EXCHANGE MECHANISMS IN SIMPLE GASES AND SOLIDS Final Report
H. P. Broida 31 Aug. 1970 20 p refs
(Contract N00014-69-A-0200-8004; ARPA Order 125)
(AD-714008) Avail: NTIS CSCL 7/4

A list of publications, degrees, grants, and lectures on optical spectroscopy in molecular physics research at the University of Santa Barbara is given. GRA

N71-16599*# Texas Christian Univ., Fort Worth.
RADIATIVE INTERACTIONS OF ELECTRONS WITH MATTER Final Report
L. L. Baggerly and C. A. Quarles Jul. 1969 34 p refs
(Contract NAS8-21421)
(NASA-CR-102994) Avail: NTIS CSCL 20H

The research equipment was assembled and checked out. Prepartory to the actual coincidence measurements, studies of the total inelastic spectrum were made. It was found that a study of K X-ray production in coincidence with inelastically scattered electrons (the K shell ionization process) is an important contribution to the inelastic spectrum and should also be studied in detail. The study of thet total inelastic spectra and the bremsstrahlung and K ionization coincidence spectra will be continued. Author

N71-16607*# Translation Consultants, Ltd., Arlington, Va.
THEORETICAL PHYSICS: STUDY OF THE GRAVITON EMISSION PROCESS [PHYSIQUE THEORIQUE: ETUDE DE PROCESSUS d'EMISSION DE GRAVITONS]
A. Tourrenc Washington NASA Jan. 1971 7 p refs Transl. into ENGLISH from Compt. Rend., Ser. B, Sci. Phys. (Paris), v. 271, no. 2, 15 Jul. 1970 p 61-72
(Contract NASw-2038)
(NASA-TT-F-13448) Avail: NTIS CSCL 20H

Study of the processes of annihilation of a pair of photons in a pair of gravitons, was continued using methods and notations previously determined. Attention was also given to the emission of an infrared graviton in the collision of two scalar particles. Author

N71-16608*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROTON RECOIL MEASUREMENTS OF THE PuBe SOURCE NEUTRON SPECTRA
R. L. Alexander, D. F. Shook, and C. H. Ford [1971] 9 p refs Proposed for presentation at Nucl. Sources and Appl. meeting, Augusta, Ga., 18-21 Apr. 1971; sponsored Am. Nucl. Soc.
(NASA-TM-X-52954) Avail: NTIS CSCL 20H

The spectrum of a 5 Ci PuBe neutron source was measured from 40 keV to 800 keV. The measurement was made using a spherical proportional counter containing 4 atmospheres of hydrogen. Pulses due to gamma-ray interactions in the chamber were distinguished by rise time analysis using a two-parameter pulse-height analyzer. The proton recoil spectrum was analyzed using a code written by Benjamin which accounts for contributions to the proton recoil spectrum from neutrons of energy greater than that to be analyzed. The proportional counter measurement is combined with a recent liquid scintillator measurement to give a complete spectrum. Good agreement exists between the two measurements in the region of overlap from 500 to 800 keV. The proportional counter data show that the flux is fairly smooth and flat in the region from 40 keV to 800 keV. The present measurements indicate a neutron yield below 1 MeV for this source of 20.2 + or - 3.9 percent. Author

N71-16609# Washington Univ., Seattle. Dept. of Chemistry.
UNIMOLECULAR DECOMPOSITION AND INTRAMOLECULAR ENERGY RELAXATION IN THE SUPRA-HIGH PRESSURE REGION
B. S. Rabinovitch, I. Oref, and D. Schuetzle 1 Oct. 1970 18 p Submitted for publication
(Contract N00014-67-A-0103-0019)
(AD-714020; TR-15) Avail: NTIS CSCL 7/4

The study of the unimolecular decomposition of chemically activated butyl-2 radicals was extended to over 200 atm. of bath gas (H2) pressure. No evidence for failure of the internal energy randomization postulate is evident in this system at a mean time between collisions of 2 x 10 to the -13th sec. Author (GRA)

N71-16678*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACECRAFT POWER
In its Space Programs Sum. No. 37-65, Vol. 3, Aug. – Sep. 1970 31 Oct. 1970 p 58–95 refs (See N71-16671 06-30)
Copyright. Avail: NTIS CSCL 20H

Development of spacecraft power systems is discussed, including neutron yield from (alpha, n) reaction with O-18 isotope, evaluation of SNAP-19 TAGS thermoelectric generator, activation energy of annealing in lithium-doped silicon, a long-life 30 A-h sealed AgO-Zn battery, lightweight solar panels, heat sterilizable batteries, permeability of membranes, reaction geometry of the alkaline silver electrode, electric propulsion power conditioning, and thermoelectric generator performance correlation. R.B.

N71-16707# California Univ., Irvine.
REGGE POLE CONFERENCE
1969 287 p refs Conf. held at Irvine, Calif., 5–6 Dec. 1969 Sponsored by AEC
(CONF-691202) Avail: NTIS

Abstracts of 33 contributed papers are presented aolong with the text of 6 manuscript papers. The latter papers are on the following topics: (1) Regge analyses of high energy scattering data, (2) phenomenological analyses using poles and cuts, (3) Veneziano representation, (4) multiperipheral dynamics, (5) phenomenology of multiparticle production, and (5) Regge poles in non-strong processes. E.C.

N71-16724# Pennsylvania Univ., Philadelphia. Dept. of Physics.
SHAPES OF ANGULAR DISTRIBUTIONS OF (He-3,t) AND (p,n) TRANSITIONS TO 0(+) ANTIANALOG STATES
J. V. Noble 1 Oct. 1970 8 p refs
(Contract AT(30-1)-2171)
(NYO-2171-321) Avail: NTIS

The anomalous (Delta L = 1) shapes of the angular distribution of tritons from the 0(+) – 0(+) He-3 induced charge exchange transitions to antienalog states of GA-64, Ga-66, and K-40 can be understood on the basis of the structural relation between analog and antianalog states, together with the assumption of pure change-exchange (i.e., no knockout) mechanism. Author (NSA)

N71-16726# California Univ., Berkeley. Lawrence Radiation Lab.
SOTRM: A PROGRAM TO GENERATE FIRST AND SECOND ORDER MATRIX ELEMENTS BY TRACKING CHARGED PARTICLES IN A SPECIFIED MAGNETIC FIELD
Elon R. Close 12 May 1970 48 p refs
(Contract W-7405-eng-48)
(UCRL-19823) Avail: NTIS

A CDC 6600, FORTRAN 4 program, SOTRM, is described which SOTRM generates first and second order transformation elements by integrating numerically through a specified magnetic field. It can also be used for ray tracing. Data input is described and an illustrative example is presented. The results obtained can be used in a matrix beam transport program. Author (NSA)

N71-16740# General Electric Co., Schenectady, N.Y. Knolls Atomic Power Lab.
CONCERNING THE RELATIONSHIP BETWEEN THE ELASTIC CONSTANTS AND PHENOMENOLOGICAL INTERATOMIC POTENTIALS
David M. Brudnoy Apr. 1970 19 p refs
(Contract W-31-109-eng-52)
(KAPL-M-7131) Avail: NTIS

The relationship between macroscopic second-order elastic constants and the microscopic interatomic potential in a crystal is derived for two-body central interactions and arbitrary geometric lattice. The Cauchy relations are not necessarily satisfied because initial stresses are included in the expressions. Several matters pertaining to the allowed symmetries of the elastic constants, discussed sometimes incorrectly in the literature, are clarified. Explicit expressions are derived for the case of fcc, bcc, and hcp crystals. Author (NSA)

N71-16741# Minnesota Univ., Minneapolis. Particle Technology Lab.
FUNDAMENTAL STUDY OF INERTIAL IMPACTORS
Virgil Alan Marple (Ph.D. Thesis) Sep. 1970 281 p refs Sponsored by AEC
(COO-1248-21) Avail: NTIS

A systematic study has been made on the inertial impactor, a device used for the collection of aerosol particles. Impactors of both the round and the rectangular geometry was investigated. A computational procedure was developed to predict the characteristics of the impactor, to verify the results experimentally for a few selected cases, and when the apply the procedure to a systematic study of the impactor. The influence of such variables as jet-to-plate distance, the Reynolds number and the throat length was investigated. The theoretical procedure was based upon the solution of the Navier-Stokes equation for the flow field and the integration of the equation of motion of the particles for the particle trajectory. Both the solution to the Navier-Stokes equation and the integration of particle trajectory were done numerically on a digital computer. Author (NSA)

N71-16742# Virginia Polytechnic Inst., Blacksburg. Dept. of Chemistry.
APPLICATION OF POSITRON ANNIHILATION AS A CHEMICAL PROBE
Hans. J. Ache [1970] 8 p refs Presented at the 6th Intern. Symp. on Microtech., Graz, Austria
(CONF-700915-1) Avail: NTIS

The potential of positron annihilation and positronium formation as an analytical tool for solution of certain problems in chemistry is discussed. Examples of the use of this method include: phase transition studies, radioinduced solid-state reaction studies, and radiation defect studies in ionic crystals. NSA

N71-16743# Hawaii Univ., Honolulu.
NONLEPTONIC DECAY AND THE CURRENT TIMES CURRENT THEORY
S. Pakvasa and S. P. Rosen (Purdue Univ.) Apr. 1970 37 p refs Presented at the Symp. on the Past Decade in Particle Theory, Austin, Tex.
(Contract AT(04-3)-511)
(UH-511-73-70; CONF-700424-1) Avail: NTIS

The survey of nonleptonic hadron decay in current × current theory includes decays of particular hadrons, divergence problems, parity-conserving processes, and parity-violating nuclear forces. NSA

N71-16754# Bettis Atomic Power Lab., Pittsburgh, Pa.
DUZ-2: PROGRAM FOR SOLVING AXISYMMETRIC AND PLANE ELASTIC-PLASTIC PROBLEMS ON THE CDC-5600 (LWBR DEVELOPMENT PROGRAM)
C. M. Friedrich, W. H. Guillinger, L. A. Hageman, C. Jeffrey, and W. D. Peterson Sep. 1970 199 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-926) Avail: NTIS

DUZ-2 is a digital computer program for solving inelastic two-dimensional plane and axially symmetric problems. Loading conditions may arise from nonuniform temperatures, body forces, and boundary displacements or forces. Bodies may be nonhomogeneous, and all material properties may be temperature-dependent. Inelastic stress-strain relations may be expressed by piecewise linear curves or by power fits. Up to 5000 mesh points are allowed, with variable mesh and diagonal boundaries. Author (NSA)

N71-16755# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.
MULTIPLE PHOTON IONIZATION OF ATOMS
N. B. Delone et al Sep. 1970 22 p refs Transl. into ENGLISH of Akad. Nauk SSSR, Moscow, Preprint No. 11 Presented at the 4th All-Union Conf. on the Phys. of Electron and Atom Collisions, Riga, 15–20 Sep. 1969
(AEC-tr-7167; Conf-690965-1; DWR-1579) Avail: NTIS

The recently discovered new process leading to the ionization of atoms by an electromagnetic field, the multiphoton ionization, is reviewed. In this case, ionization occurs as the result of the absorption of photons by atomic electrons; the energy of these photons is much lower than the ionization potential of the atom. The required high-intensity monochromatic radiation may be obtained only by the use of lasers. The process was first observed in 1965 by one of the authors in the case of the ionization of xenon atoms and hydrogen molecules by the radiation emitted by a ruby laser. The strong radiation field needed to observe the effect not only induces electron transitions from one stage to another but also changes these states. The probability of the multiphoton ionization of an atom depends on the type of polarization of the radiation and the ellipticity of the system. The theoretical explanation is based on the higher-order perturbation theory, or on the resonance excitation of an intermediate level. The experimental work requires either a high field voltage or a high specificity of the individual ionization related to the absorption processes. NSA

N71-16759# California Univ., Berkeley. Lawrence Radiation Lab.
EXPERIMENTAL LIMIT ON THE BRANCHING RATIO FOR NEUTRAL KAON SUB L YIELDS I I BAR
A. R. Clark, T. Elioff, R. C. Field, H. J. Frisch, R. P. Johnson et al 17 Aug. 1970 13 p refs Presented at the 15th Intern. Conf. on High Energy Phys., Kiev, USSR
(Contract W-7405-ENG-48)
(UCRL-20078; CONF-700806-44) Avail: NTIS

The experimental limit on the neutral kaon sub 2 yields l + l bar branching ratio was found to be 2.3. The instrumentation and data analysis for this experiment are described. NSA

N71-16770# Brookhaven National Lab., Upton, N.Y. Div. of Technical Information.
APPARATUS FOR EXTRACTION OF RADIOACTIVE ARGON FROM A CHLORINE-CONTAINING SUBSTANCE
V. N. Gavrin et al Sep. 1970 5 p refs Transl. into ENGLISH from Kosm. Luchi (USSR), No. 10, 1969 p 20–22
(BNL-tr-364) Avail: NTIS

An installation for extracting radioactive argon from a chlorine-containing substance is described. Design features and a scheme of the installation are given. Author (NSA)

N71-16771# Syracuse Univ., N.Y. Dept. of Physics.
SOME CONSTRAINTS ON PARTIAL WAVES OF HELICITY AMPLITUDES WHICH FOLLOW FROM ANALYTICITY, UNITARITY, AND CROSSING SYMMETRY
William Case Aug. 1970 19 p refs
(SU-1206-231; NYO-3399-231) Avail: NTIS

Some inequalities involving finite numbers of partial wave helicity amplitudes are derived for the elastic scattering process ab yields ab (arbitrary spins and masses). One set of inequalities involves algebraic combinations of t-channel (aa bar yields bb bar) partial wave helicity amplitude and holds for any value of t between 0 and 4 sq mu (mu is the least mass of the two particles involved in the scattering). A second set places restrictions on integrals over s-channel (ab yields ab) partial wave helicity amplitudes. Finally, the above relations are applied to the particular case of neutral pion-nucleon elastic scattering where inequalities among partial wave helicity amplitudes are obtained. Author (NSA)

N71-16772# California Univ., Berkeley. Lawrence Radiation Lab.
POSSIBILITY OF ACCELERATING POLARIZED PROTONS IN THE RING-O-TRON
L. I. Lapidus et al Sep. 1970 22 p refs Transl. into ENGLISH of Russian report JINR-P1-5209 In ENGLISH and RUSSIAN
(UCRL-Trans-1419; JINR-P1-5209) Avail: NTIS

The electron ring accelerator may be very useful for the production of polarized particles of high intensity. It is due to the fact that polarized ions are accumulated in the electron ring during the time of injection (approximately 1 msec). The crucial problem is to conserve polarization during the time of injection and acceleration. The estimations for P show that the decrease of the number of electrons is necessary for producing polarized ions with a high polarization degree. The limit is rather high for the projected parameters of the compressor. The polarized proton beam after acceleration will have the longitudinal polarization, which can be changed to the transversal polarization, if necessary, with the magnet. The sign of polarization can be changed every pulse that gives possibilities for sensible experiments on the P, T-parity conservation. Some essential experiments are discussed. Author (NSA)

N71-16773# Hawaii Univ., Honolulu.
COMMENTS ON THE COMPATIBILITY OF THE VENEZIANO MODEL WITH CURRENT ALGEBRA AND CHIRAL SYMMETRY
P. N. Dobson, Jr. and W. A. Simmons Sep. 1970 7 p refs
(Contract AT(04-3)-511)
(UH-511-79-70) Avail: NTIS

It is shown that the Veneziano model with off-shell correction factor is compatible with the (3,3*) + (3*,3) symmetry-breaking scheme. The K pion scattering is discussed. NSA

N71-16774# California Univ., Berkeley. Lawrence Radiation Lab.
REVIEW OF PARTIAL-WAVE ANALYSES OF THE ANTIKAON NUCLEON SYSTEM ABOVE 1.1 GeV/c KAON(-) BEAM MOMENTUM
Angela Barbaro-Galtieri Jun. 1970 32 p refs Presented at the Intern. Conf. on Hyperon Resonances, Durham, N.C.
(Contract W-7405-eng-48)
(UCRL-19843; Conf-700416-9) Avail: NTIS

A review of all partial-wave analyses done so far in the mass region 1850 to 2250 MeV is presented. Only the Lambda hyperon pion and Sigma hyperon pion channels were analyzed in detail for hyperon states in all partial waves. Some information is also available for the negative kaon proton and neutral antikaon neutron systems as well as the Xi hyperon kaon system. A total of four I = 0 states and seven I = 1 states were claimed in this energy region, of which only one and five respectively were seen in at least two channels. The uniqueness of solutions obtained in the analysis of a single channel is discussed. Author (NSA)

N71-16787# Purdue Univ., Lafayette, Ind. Dept. of Physics.
DOUBLE-REGGE POLE ANALYSIS OF PION(+) PROTON YIELDS PION(+) f(0) PROTON AT 13.1 GeV/c
J. A. Gaidos, C. R. Ezell, J. W. Lamsa, and R. B. Willmann [1970] 24 p refs
(Contract AT(11-1)-1428)
(COO-1428-237) Avail: NTIS

A double-Regge model consistent with duality is applied to the reaction positive pion proton yields positive pion f(0) proton at 13.1 GeV/c. The diffractively produced pion f(0) system is well described by two amplitudes involving Pomeranchuk/A sub 2 and Pomeranchuk/f(0) exchanges. Author (NSA)

N71-16811# California Univ., San Diego.
REDEMPTION OF THE DUAL DESCRIPTION OF PRODUCTION PROCESSES BY UNITARITY. THE RELEVANCE OF THE EIKONAL MODEL
John Francis Gunion (Ph.D. Thesis) 1970 85 p refs
(Contract AT-11-1-GEN-10)
(UCSD-10-P-10-76) Avail: NTIS

A modified Baker-Blankenbecler type formalism is derived which is used to apply unitarity corrections to the Veneziano model and its generalization to many-point functions. As a result an eikonal-like pole-cut model is obtained for elastic scattering and for production processes. It is found that inclusion of unitarity corrections allows one to retain the assumptions of factorization, exchange degeneracy and duality in contrast to the previous applications of the generalized Veneziano model. The extension of the model to include spin leads in a natural way to the conservation of s-channel helicity by the Pomeranchuk. Author (NSA)

N71-16812# California Univ., Berkeley. Lawrence Radiation Lab.
NEUTRAL KAON RESONANCE PRODUCTION IN K(+)d INTERACTIONS AT 12 GeV/c
A. Firestone, G. Goldhaber, and D. Lissauer Aug. 1970 17 p refs Presented at 15th Intern. Conf. on High Energy Phys., Kiev, 26 Aug.–4 Sep. 1970
(Contract W-7405-ENG-48)
(UCRL-20076; CONF-700806-48) Avail: NTIS

Preliminary results are reported on positive kaon + neutron yields positive kaon + negative pion + proton and positive kaon + neutron yields neutral kaon + positive pion + negative pion + proton interactions at 12 GeV/c in a deuterium bubble chamber. In the first reaction several N* resonances and K*(890) and K*(1420) and also the K*(1250) is found. There was also a signal at 1360 with J sup P is unequal to 2(+) observed. In the second reaction only the K*(1420) is seen. NSA

N71-16813# California Univ., Berkeley. Lawrence Radiation Lab.
REVIEW OF THE KAON NUCLEON AND ANTIKAON NUCLEON TOTAL CROSS SECTIONS BELOW 3.5 GeV/c
Gerald Lynch Jun. 1970 38 p refs Presented at Intern. Conf. on Hyperon Resonances, Durham, N.C.
(Contract W-7405-eng-48)
(UCRL-19844; CONF-700416-10) Avail: NTIS

The positive kaon and negative kaon total cross sections from 0.4 to 3.4 GeV/c and the derived cross sections in the I = 0 and I = 1 channels are presented in such a way that one can determine how well the different experiments agree concerning various features of the data and to what extent some of the conclusions are doubtful from uncertainties introduced during the analysis. NSA

N71-16814# Chicago Univ., Ill. Dept. of Chemistry.
QUANTUM MECHANICAL CALCULATIONS OF LIGHT METAL DIATOMIC HYDRIDES, OXIDES AND HALIDES Final Report, 12 Jun. 1968–11 Jun. 1970
Clemens C. J. Roothaan and Juergen Hinze 11 Jun. 1970 14 p refs
(Contract DA-31-124-ARO(D)-447; ARPA Order 368)
(AD-713977) Avail: NTIS CSCL 7/4

Briefly discussed is research involving the use of Hartree-Fock computer programs to calculate molecular wavefunctions. GRA

N71-16816# Brookhaven National Lab., Upton, N.Y.
SOME NEW DATA ON NEUTRON SPECTROSCOPY OF HEAVY NUCLEI
S. I. Sukhoruchkin [1970] 26 p refs Transl. into ENGLISH from At. Energ. (Moscow), v. 28, 1970 p 38–48
(BNL-TR-351) Avail: NTIS

Some new features in the data on neutron spectroscopy of heavy nuclei obtained in the last two or three years are examined. Some of them, such as structure in subthreshold fission, seem to have been established fairly reliably; others, such as the spin dependence of the strength function and the systematic variation of radiation widths, must still be verified. Intermediate structure in the cross sections (on the scale of 1 keV) of heavy nuclei are considered, and the agreement between recent experimental data and the earlier assumptions about the statistical nature of the properties of neutron levels is examined. The areas treated are radiation widths of heavy nuclei, fission widths of the neutron resonances, dependence of the neutron strength function of the spin of the compound nucleus, and level-spacing distributions. NSA

N71-16817# Brookhaven National Lab., Upton, N.Y.
NEUTRON-ELECTRON INTERACTION
Yu. A. Aleksandrov [1970] 22 p refs Transl. into ENGLISH from the Russian Report
(BNL-TR-372; JINR-P3-4783) Avail: NTIS

This review of the electron-neutron interaction covers the experimental techniques for determining the neutron-electron interaction, theoretical analysis of the interaction, and a study of this interaction using neutron diffraction by a single crystal of tungsten. NSA

N71-16837# California Univ., Berkeley. Lawrence Radiation Lab.
MEASUREMENT OF THE BRANCHING RATIO KAON(+) YIELDS POSITRON NEUTRINO TO KAON(+) YIELDS MUON(+) NEUTRINO
A. R. Clark, B. Cork, T. Elioff, L. T. Kerth, J. F. McReynolds et al 20 Aug. 1970 14 p refs Presented at the 15th Intern. Conf. on High Energy Phys., Kiev, USSR
(Contract W-7405-eng-48)
(UCRL-20079; CONF-700806-45) Avail: NTIS

The measured branching ratio Kaon(+) yields positron neutrino to Kaon(+) yields Muon(+) neutrino was found to be 2.15 + or – 0.000035. The instrumentation and data analysis for these decays are described. NSA

N71-16838# Stanford Linear Accelerator Center, Calif.
MEASUREMENT OF THE TWO PHOTON DECAY OF THE K(0) SUB L MESON
James E. Enstrom Sep. 1970 108 p refs
(Contract AT(04-3)-515)
(SLAC-126) Avail: NTIS

A measurement of the rate Gamma (kaon sub L yields 2 gamma) was made relative to the rates Gamma (kaon sub L yields 3 pion(0), (0)), (kaon sub L yields pion(+ or -) muon mu-neutrino) and Gamma (kaon sub L yields pion(+ or -) electron(- or +) e-neutrino using a spark chamber, scintillation counter experiment. Using published branching ratios of the three body decays relative to the rate Gamma (kaon sub L yields all), the

branching ratio Gamma (kaon sub L yields 2 gamma) to Gamma (kaon sub L yields all) has been found to be (4.5 + or − 1.0) × 0.0001, based on 23 valid decays, which were separated from a small background. The result is compared with theoretical predictions and other experimental measurements. Author (NSA)

N71-16839# Illinois Univ., Urbana.
A TEST OF THE DELTA S EQUALS DELTA Q SELECTION RULE IN K(0) SUB e3 DECAY
Paul Matthew Mantsch (Ph.D. Thesis) Oct. 1970 67 p refs
(Contract AT(11-1)-1195)
(COO-1195-195) Avail: NTIS

An experiment was performed to test the validity of the Delta S equals Delta Q weak interaction selection rule for the decay kaon(0) (anti kaon(0)) yields pion (+) electron neutrino. The kaons(0) were produced by a 3-GeV pion(−) beam on a carbon target in the reaction pion(−) proton yields Lambda hyperon(0) kaon(0). Events were reconstructed on the basis of the trajectories of the kaon decay products in optical spark chambers located in a magnetic field. The electron from the decay was identified by its shower in heavy plate spark chambers. The presence of the associated Lambda hyperon(0) was deduced from its decay Lambda hyperon(0) yields pion(−) proton in spark chambers near the target. Decay times for the kaons(0) were measured over a proper time interval of 0.5 to 6.5 kaon(0) sub S lifetimes from production. Decay time distributions for both signs of the decay lepton were corrected for geometrical efficiency and fit to theoretical distributions. Author (NSA)

N71-16843# Centralny Instytut Informacji Naukowc-Technicznej i Ekonomicznej, Warsaw (Poland).
NUKLEONIKA
1969 190 p refs Transl. into ENGLISH from Nukleonika (Warsaw), v. 14, no. 7/8, 1969 p 679−884 Prepared for AEC and NSF
(AEC-tr-7027/7-8; TT-69-50012/7-8) Avail: NTIS

A theoretical discussion on the design concept of a rod plasma injector for creating a highly focused stream of hot plasma is presented. Solid electrodes of the coaxial plasma gun were replaced by grid electrodes so that the radial motion of particles becomes unlimited and a strong concentration of particles at the axis can be achieved. Using a one particle model, the basic relations for perfectly transparent and perfectly smooth electrodes were derived. Space charges are briefly discussed. Plasma luminosity in the rod plasma injector was observed by a SFR-2M ultraspeed camera. The pictures obtained confirm theoretical forecasts based on the one particle model. Observations in the presence of an axial magnetic field of the order of 5 kG were also performed. J.A.M.

N71-16844# Notre Dame Univ., Ind.
THEORETICAL PHYSICS IN THE FIELD OF INTERACTION OF PHOTONS AND PARTICLES WITH NUCLEI Technical Progress Report, 1 Nov. 1969 −31 Oct. 1970
15 Jul. 1970 19 p refs
(Contract AT(11-1)-427)
(COO-427-105) Avail: NTIS

Research progress at the University of Notre Dame from Nov. 1, 1969 to Oct. 31, 1970 in theoretical studies of the interactions of photons and particles with nuclei is reported. NSA

N71-16845# Illinois Univ., Urbana. Dept. of Physics.
STUDY OF THREE PION FINAL STATE INTERACTIONS IN THE REACTION PION(−) PROTON YIELDS PROTON PION(+) PION( ) PION(−) AT 5 AND 7.5 GeV/c
Dennis Vern Brockway (Ph.D. Thesis) Oct. 1970 130 p refs
(Contract AT(11-1)-1195)
(COO-1195-197) Avail: NTIS

A new partial wave analysis is applied to the 3 pion enhancement between 1.0 to 1.4 GeV in the reaction negative pion proton yields proton positive pion negative pion at 5 and 7.5 GeV/c. This method of analysis allows the determination of the contributions of the different spin parity states to the overall enhancement. The relative importance of the different spin parity states are obtained as a function of 3 pion mass. It is found that only the 2(+) state shows a definite resonant behavior at a 3 pion mass of 1305 MeV. This is the well known A sub 2 meson. The 3 pion mass region below the A sub 2 is found to be dominated by the 1(+) sub 2 state. No evidence is found for a 1(+) sub d state at these energies. The overall features of the spin parity states in the 3 pion enhancement strongly suggest the interpretation of Deck + A sub 2 for the 3 pion mass spectra. The polarization of the A sub 2 meson is found to be consistent with the exchange of a particle of natural parity (neutral rho or neutral f meson) and the polarization of both halves of the A sub 2 are found to be the same. Author (NSA)

N71-16853# Hawaii Univ., Honolulu.
INELASTIC INTERACTIONS OF NEUTRINOS IN THE NAL HYDROGEN BUBBLE CHAMBER: SOME IDEAS ABOUT ASSOCIATED MUON, PHOTON, AND HADRON DETECTORS
Robert J. Cence, Michael W. Peters, Vincent Z. Peterson, and David E. Yount 4 May 1970 11 p
(UH-511-80-70) Avail: NTIS

In the discussion of the proposed experiment on inelastic interactions of neutrinos in the hydrogen bubble chamber, consideration is given to accurate determination of the incident neutrino energy, resolution of muonic electromagnetic and hadronic components of final-state energy and particle flux, maximum detail in event reconstruction, and simplicity and flexibility of apparatus needed in addition to the bubble chamber. Details of the design are given. NSA

N71-16854# Sheffield Univ. (England). Dept. of Chemistry.
APPLICATIONS OF QUANTUM MECHANICS TO MOLECULES CONTAINING HEAVY ATOMS Final Technical Report, Sep. 1969 −Oct. 1970
R. McWeeny, C. D. H. Chisholm, and D. B. Cook Nov. 1970 43 p refs
(Contract DAJA37-70-C-0214)
(AD-714259; ARDG(E)-E-1425) Avail: NTIS CSCL 7/4

Discussed is research on a conventional ab initio LCAO SCF MO method, with a basis of atomic orbitals and inclusion of interactions among all electrons and nuclei; and an approach based on the recognition of the chemical divisions of the electronic structure into metal cores, ligand omega frameworks and the valence shell. Results available so far have allowed a complete test of all computer programs and have demonstrated the feasibility of both types of calculation. Also reported is research on perturbation theory - providing various alternative routes to the calculation of the structure and properties of many-electron systems. In particular it should permit the discussion of electronic properties within iso-electronic families of molecules in which the nuclear charges vary (e.g. as in changing the ligands or the metal in a complex). The use of perturbation theory leads to new theoretical problems, some of which are here investigation for the first time. Preliminary calculations on very simple systems have given encouraging numerical results. Author (GRA)

N71-16855# Institute for Advanced Study, Princeton, N.J.
GENERAL LOCAL INTERACTIONS AND TESTS OF V-A THEORY IN NEUTRINO SCATTERING PROCESSES
T. P. Cheng and Wu-ki Tung (Chicago Univ.) Sep. 1970 47 p refs

(Contract AT(11-1)-264)
(COO-264-559; EFI-70-51) Avail: NTIS

Neutrino scattering processes are studied in the framework of general local current-current interaction. The scattering amplitudes for such processes are expressed in a simple factorized form in terms of helicity form factors for the current vertex functions. These expressions explicitly display the full kinematic content of the local current-current interaction and are used as the basis for a systematic study of possible ways to test the V-A structure of the weak current in high energy neutrino scattering processes. A direct test in an inclusive experiment consists of measuring the outgoing lepton polarization. Alternative tests from angular and spin correlations are possible only in exclusive experiments. Several examples of this latter type of experiments are given: pure lepton scattering processes, neutrino scattering off spin zero (nuclei) targets, quasi-elastic scattering off polarized nucleon, quasi-elastic hyperon production (decay asymmetry) and (v) single pion production in the N* region. Author (NSA)

N71-16856# Columbia Univ., New York. Pegram Nuclear Physics Labs.
[NUCLEAR PHYSICS] Progress Report, Jan. – Dec. 1969
[1970] 215 p refs
(Contract AT(30-1)-73)
(NYO-73-293) Avail: NTIS

Progress in various nuclear physics experiments is reported, including neutron physics, nuclear reactions with charged particles, and beta and gamma spectroscopy and its application to nuclear structure and weak interaction studies. A muonic atom and nuclear structure investigation is reviewed, along with neutron interactions with condensed matter and kinetics of neutron and photon gases. Progress is also described on the development of a time analyzer, 262,000 channel time-of-flight analyzer, PHA interface, 256 channel ADC interface, and SEL card reader and line printer interfaces. J.A.M.

N71-16857# Atomic Energy Commission, New York. Health and Safety Lab.
DOSIMETRY STUDY OF THERMALLY STIMULATED EXOELECTRON EMISSION (TSEE) WITH LITHIUM FLUORIDE
Gail de P. Burke and Harold L. Beck Aug. 1970 19 p refs
(HASL-236) Avail: NTIS

In an effort to find a precise and practical radiation dosimetry technique for personnel, low level, and background monitoring, the phenomenon of thermally stimulated exoelectron emission (TSEE) in lithium fluoride was investigated. The feasibility of assembling a workable TSEE readout system from standard laboratory equipment was tested and some TSEE properties of LiF powder dosimeters were studied. A description of the apparatus used and experimental results are presented. Both the net exoelectron emission counts and the peak height (exoelectron emission count rate at the peak maxima) from lithium fluoride powder vary linearly with dose from about 100 mR to 100 R, and the powder has a sensitivity of 800 counts per roentgen with a 9 millimeter diameter dosimeter. Author (NSA)

N71-16868# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
KINETICS AND THERMODYNAMICS OF THE CN MOLECULE: THE DISSOCIATION OF C2N2
M. W. Slack, E. S. Fishburne, and A. R. Johnson Jan. 1971 23 p refs Submitted for publication
(RE-402J) Avail: NTIS

A shock tube investigation of the dissociation of cyanogen diluted in argon is described. Dissociation rate coefficients for a CN reaction were obtained behind the incident shock wave over the temperature range 2700–4000 K and for mixtures containing from 0.05 to 1.0 percent C2N2. The current measurements were in good agreement with the lower temperature data. Author

N71-16869*# University of Southern Calif., Los Angeles. Dept. of Chemistry.
[MOLECULAR SPECTROSCOPIC RESEARCH] Final Technical Report
Thomas C. James 12 Jan. 1971 12 p refs
(Grant NGR-05-018-065)
(NASA-CR-116176) Avail: NTIS CSCL 20H

Reports are briefly presented on the intensity of the quadrupole rotation vibration spectrum of molecular hydrogen and calculation of predissociation rates of the B state of iodine. A list of publications and reprints is also included. J.A.M.

N71-16870 Purdue Univ., Lafayette, Ind.
THE ELECTRON DENSITY AND ELECTROSTATIC POTENTIAL FIELD OF AN IONOSPHERIC SATELLITE
Joseph Ernest Graetch (Ph.D. Thesis) 1969 95 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 70-3894

The electron density distribution and the potential field in the near wake of a spherical, conducting satellite with a constant surface potential are determined. The effect of the wake's potential field and the earth's magnetic field on the motion of the electron is accounted for. It is shown that, in the near wake, these fields do not influence the ion motion. Guiding center theory is used to find the electron flux to a surface whose normal is within 45 degrees of the direction of the earth's magnetic field lines. Solutions for the electron density distribution and the potential field are presented in graphical form as a function of R/D, the ratio of satellite radius to Debye length, and beta, the angle between the satellite velocity and the earth's magnetic field lines. Solutions are given for values of R/D of 200, 500 and 1000, and values of beta of 0, 15, 30, 45 and 90 degrees. Dissert. Abstr.

N71-16888# California Univ., Berkeley. Lawrence Radiation Lab.
STUDY OF LAMBDA-NUCLEON INTERACTIONS IN DEUTERIUM
J. A. Kadyk, J. H. Chan, P. Gaposchkin, and G. H. Trilling Aug. 1970 10 p refs Presented at the 15th Intern. Conf. on High Energy Phys., Kiev, USSR
(Contract W-7405-eng-48)
(UCRL-20077; CONF-700806-48) Avail: NTIS

Inelastic Lambda hyperon-nucleon interactions below 1.500 GeV/c in a deuterium bubble chamber were observed. Momentum and angular distributions and cross sections for the interactions Lambda hyperon + deuteron yields negative Sigma hyperon + 2 protons and Lambda hyperon + deuteron yields Lambda hyperon + 2 protons + negative pion and the Lambda hyperon pathlength distribution were found. NSA

N71-16891# Hawaii Univ., Honolulu.
EXTERNAL VERSUS INTERNAL MUON IDENTIFICATION IN THE 15-FOOT BUBBLE CHAMBER
A. Mukhin and D. Yount 22 Jul. 1970 13 p refs
(Contract AT(04-3)-511)
(UH-511-84-70) Avail: NTIS

Two methods for identifying muons from neutrino interactions in the 15-foot bubble chamber are compared: the first uses a 1-m-thick lead plate inside a neon filling; the second uses optical spark chambers interspersed with walls of concrete external to the bubble chamber. Author (NSA)

N71-16892# California Univ., Irvine. Dept. of Physics.
MULTIPION FINAL STATES IN ANTIPROTON PROTON ANNIHILATIONS AT 940 MeV/c

R. R. Burns, P. E. Condon, J. Donahue, M. A. Mandelkern, and J. Schultz [1970] 20 p refs Presented at the 15th Intern. Conf. on High Energy Phys., Kiev, USSR Sponsored by AEC
(CONF-700806-49) Avail: NTIS

Results are reported on four pion and five pion final states from antiproton annihilations in hydrogen in the vicinity of 940 MeV/c. Cross sections for 4 pions and 5 pions are found to be 3.6 and 14.6 mb, respectively. Abundant resonance production is observed, with fits indicating that quasi-two-body production constitutes approximately half the four pion events. Evidence of rho meson-omega meson interference in these events is also presented. Author (NSA)

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N71-15735# Saha Inst. of Nuclear Physics, Calcutta (India). Theoretical Nuclear Physics Div.
VLASOV EQUATION IN A MAGNETIC FIELD
Padmanabha Dasgupta and Brahmananda Dasgupta [1970] 41 p refs
(SINP-TH-68-9) Avail: AEC Depository Libraries

The derivation of the Vlasov kinetic equation, together with the screening function for a plasma in a uniform magnetic field, is discussed within the framework of the diagram technique of Prigogine and Balescu. The Van Kampen–Case eigenfunctions for magnetoplasma are obtained from the linearized Vlasov equation. These functions form a complete orthogonal set and their use may greatly simplify various magnetoplasma calculations. An application to a certain integral equation, obtained by Haggerty and de Sobrino in connection with the ring equation and calculation of correlations with magnetoplasma, is also discussed. Author (NSA)

N71-15736# California Univ., Livermore. Lawrence Radiation Lab.
DIRECT CONVERSION OF FUSION ENERGY TO ELECTRICITY
R. F. Post 14 Sep. 1970 11 p refs Presented at the Intersociety Energy Eng. Conf., Las Vegas, Nev., 21–25 Sep. 1970 Submitted for publication Sponsored by AEC
(UCRL-72411; CONF-700915-5) Avail: NTIS

Plasma ions and electrons diffusing out of the confinement zone carry not only kinetic energy imparted by the injection and heating processes employed but also energy derived from the fusion reactions. A method is described for the direct conversion to HVDC, at high efficiency, of energy from charged particle streams emerging from the fusion reactions. The method involves four steps: 1) expansion in static magnetic fields to convert rotational energy components to longitudinal and to reduce the particle stream density; 2) separation of ions and electrons; 3) electrostatic deceleration and selective collection of the separated particle stream to produce dc currents; and 4) reduction of recovered energy to common dc potential for use as HVDC. Theoretical analyses of the overall characteristics of such a system indicate high overall conversion efficiency (90% or greater) and potentially low capital cost per kWe. The possible application of such systems to mirror machines and other types of fusion reactors is discussed, as well as some results from small-scale experiments testing the principles involved. Author (NSA)

N71-15738# Saha Inst. of Nuclear Physics, Calcutta (India). Theoretical Nuclear Physics Div.
CORRELATIONS IN PLASMA, 1
Brahmananda Dasgupta and Padmanabha Dasgupta [1970] 31 p refs
(SINP-TH-68-8) Avail: AEC Depository Libraries

The correlations of fluctuation in electric field intensity and current density are derived for nonequilibrium isotropic plasma. The calculation is based on the ring approximation results of Balescu and Taylor. The results reduced to the results obtained by Rostoker in the special case when the velocity distribution function is Maxwellian at the initial time. Author (NSA)

N71-15739# Oak Ridge National Lab., Tenn.
RADIATIVE DECAY OF COULOMB-STIMULATED PLASMONS IN Al, Be AND Mg
A. J. Braundmeier, Jr. (Ph.D. Thesis–Tenn. Univ.), E. T. Arakawa, and M. W. Williams Oct. 1970 100 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3158) Avail: NTIS

Intensity peaks in the vacuum-ultraviolet radiation spectrum emitted from electron-bombarded thin metallic films evaporated in situ were analyzed in terms of an interaction between the incoming electrons and surface plasma states in the metal. The primary effort was a study of the nonradiative surface plasmon modes in Al. These modes, which cannot decay radiatively from smooth planar films, are capable of decaying by photon emission through their interaction with surface roughness present on experimental films. The basis on which the experimentally observed intensity peaks were identified as arising from plasmon decay were: (1) the wavelength of the resonance peak, (2) the dependence of the intensity and peak wavelength on the presence of thin oxide layers on the metal, and (3) the dependence of the intensity upon the surface structure of the Al film. Author (NSA)

N71-15819*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DESIGN OF THE 20-MEGAWATT LINEAR PLASMA ACCELERATOR FACILITY
Arlen F. Carter, Willard R. Weaver, Donard R. McFarland, Stephen K. Park, and George P. Wood Washington Jan. 1970 54 p refs
(NASA-TN-D-6115; L-7405) Avail: NTIS CSCL 20I

The design of the 20-megawatt linear plasma accelerator facility at the Langley Research Center is described. This linear, steady-flow, Faraday-type plasma accelerator is intended for high-velocity aerodynamic testing and basic research in magnetohydrodynamics. Discussion is included on the general design philosophy that leads to three design criteria: (1) make the vector product of current density and magnetic flux density as large as practicable, (2) operate with approximately constant current density, and (3) maintain the Hall potential gradient constant across and along the channel. Use was made of experience and results obtained with previous smaller, lower velocity accelerators. The design exit velocity is 13 km/sec at a density that corresponds to an altitude of 53 km. Many aspects of the engineering design of the accelerator and auxiliary equipment are discussed. Author

N71-15839# Institute fur Plasmaphysik G.m.b.H., Garching (West Germany).
SMALL SOLID HYDROGEN PELLETS MADE FOR PLASMA PRODUCTION BY LASER [HERSTELLUNG KLEINER WASSERSTOFFTEILCHEN ZUER PLASMAERZEUGUNG DURCH FOKUSSIERTE LASERSTRAHLUNG]
H. Krause, P. Sachsenmaier, H. Salzmann, and R. Sigel Feb. 1970 14 p refs In GERMAN
(IPP-4/3) Avail: AEC Depository Libraries

An apparatus for producing small hydrogen pellets and injecting them into a vacuum is described. The diameter of the pellets is between 50 to 80 microns. The apparatus will be used for plasma production by evaporating the pellets with a giant pulse laser. Author (NSA)

N71-15854# Los Alamos Scientific Lab., N.Mex.
STUDIES OF TURBULENT HEATING OF HYDROGEN PLASMA BY NUMERICAL SIMULATION
R. L. Morse and C. W. Nielson Sep. 1970 5 p refs
(Contract W-7405-eng-36)
(LA-4510) Avail: NTIS

One-dimensional numerical simulation of the development of the ion–acoustic instability in a plasma with mass ratio 1836 shows considerable electron heating but only small high-temperature tails or large-amplitude, undamped ion–acoustic waves in the ion distribution. Author (NSA)

N71-15855# Sandia Corp., Albuquerque, N.Mex.
POSITIVE ION DETECTORS FOR USE WITH DIRECTED PULSED PLASMAS
Grant J. Lockwood Aug. 1970 28 p refs
(SC-RR-70-583) Avail: NTIS

A series of detectors developed to measure ion characteristics in a directed pulsed plasma is described. The mechanical design, theory of operation, and a calibration procedure are discussed. The detectors can be used to measure velocity, charge-state distribution, mass distribution, total mass, and total charge. Also included are the results of performance checks using the plasmas from a coaxial rail gun or from laser-induced blowoff. Author (NSA)

N71-15858*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HOT ELECTRODE DROPS IN AN UNSEEDED SUPERSONIC ARGON MAGNETOHYDRODYNAMIC GENERATOR
Maris A. Mantenieks Washington Jan. 1971 23 p refs
(NASA-TN-D-7041; E-5928) Avail: NTIS CSCL 20I

Experiments were performed in an unseeded, supersonic argon generator. Floating potential profiles, electrode drops, and electrode temperatures were measured. The following conclusions were reached: (1) Electrode drops are independent of the magnetic field. (2) The discharge is not symmetrical in the presence of a magnetic field. (3) It is possible to go from a self-sustaining arc discharge mode to a non-self-sustaining mode by increasing the initial cathode temperature. (4) There is a cathode temperature (about 2250 K) for which a minimum cathode drop is found. (5) A cooling effect for low discharge current is observed at the cathode in the non-self-sustaining mode. This cooling depends on the magnetic field. Author

N71-15861 Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
CYCLOTRON RESONANCE IN SOLID-STATE PLASMA
T. O. Poehler and J. R. Apel *In its* Appl Tech. Dig., Vol. 9, No. 5 Jun. 1970 p 2–12 refs (See N71-15860 06-23)
Copyright. Avail: APL, Johns Hopkins Univ., 8621 Georgia Ave., Silver Spring, Md. 20910: $0.50

The interaction of a solid-state plasma with far infrared laser radiation and with ionized impurities in large magnetic fields is investigated with respect to quantum mechanics. The changes in the quantum states of conduction electrons and in their interaction with the other excitons of the solid are considered. The results show that cyclotron resonance measurements are suitable for examining the dynamics of electrons in a crystal. R.B.

N71-16000# Plasma Sciences Labs., Inc., Terzana, Calif.
TEMPERATURE MEASUREMENTS IN NITROGEN AND NITROGEN-OXYGEN PLASMAS Final Report, 15 Jun. 1969–15 Jun. 1970
H. N. Olsen, G. Bedjai, and F. L. Kelly Arnold Air Force Station, Tenn. AEDC Oct. 1970 194 p refs
(Contract F40600-69-C-0007)
(AD-714069; AEDC-TR-70-239) Avail: NTIS CSCL 20/9

Using as a source a dc subsonic plasma jet operating in nitrogen and in nitrogen-oxygen mixtures at atmospheric pressure, emission coefficients of the N2(2+)(0,0) lambda 3371 neutral molecule band, N2(+)(1-)(0,0) lambda 3914 ionized molecular band, lambda 7468 NI atomic line, and the electron continuum have been measured over the temperature range of 3800 to 10000K. The emission coefficients of the discrete radiation, calibrated on an absolute scale, were used to calibrate the simultaneously measured electron continuum over the temperature range. Approximate analytical treatments were used to extrapolate the calibrated continuum curves to lower temperatures where discrete radiations cannot be observed. The experimental results show considerably higher continuum emission coefficients at low temperature than can be accounted for by any existing theoretical treatments. Author (GRA)

N71-16041# Sandia Corp., Albuquerque, N.Mex. Aerofluid Dynamics Div.
BLUNT-BODY ELECTROSTATIC PROBE ANALYSIS
George A. Shelton, Jr. Aug. 1970 44 p refs
(SC-RR-70-331) Avail: NTIS

The multifluid equations governing the flow of a plasma past a blunt-body, electrostatic probe are presented. The terms describing the interaction between different species are derived in general and the specific expressions for the interactions active in an argon plasma are presented. Approximations applicable to arc jet flows are made which render the system of equations soluble. The resulting equations are solved numerically, and the flow profiles are analyzed to ascertain the physical processes that dominate. Author (NSA)

N71-16073* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
APPARATUS FOR MEASURING CONDUCTIVITY AND VELOCITY OF PLASMA UTILIZING A PLURALITY OF SENSING COILS POSITIONED IN THE PLASMA Patent
Vernon J. Rossow, inventor (to NASA) Issued 23 Jun. 1970 (Filed 20 Apr. 1967) 14 p Cl. 324-34; Int. Cl. G01r33/12
(NASA-Case-XAC-05695; US-Patent-3,517,302; US-Patent-Appl-SN-634038) Avail: US Patent Office CSCL 20I

A system for measuring the conductivity and velocity of plasma streams employs a primary coil and several secondary coils magnetically linked thereto through the plasma. The positions of the secondary coils relative to the primary are such that they respond to distortions of the magnetic field produced by the presence of the electrically conductive fluid. The signals in the secondaries vary linearly with the conductivity and the product of conductivity times velocity. Official Gazette of the U.S. Patent Office

N71-16074# Texas Technological Univ., Lubbock. Plasma Lab.
FAST PLASMA HEATING FOR THE THERMONUCLEAR POWER Annual Report No. 1
M. O. Hagler and M. Kristiansen 1 May 1970 85 p refs
(Grant AF-AFOSR-1757-68)
(AD-714619; AFOSR-70-2591TR) Avail: NTIS CSCL 20/9

Four separate plasma investigations are reported. They are: ultra fast theta pinch, exploding wire, laser plasma heating, and plasma-solid interactions. The main emphasis is on the ultra fast theta pinch which emphasizes speed and experimental flexibility. It is expected that valuable information and improved performance can be achieved by depositing the external energy into the plasma in the shortest time possible. Several important instabilities with relatively slow growth rates may thus become less important. The exploding wire research has already received active internal

funding and a small exploding wire facility is operational. Particular emphasis is placed upon the diagnostics of the produced plasmas. The plasma parameters will be carefully determined so that meaningful comparisons can be made between experimental findings and theoretical predictions. Theoretical considerations are given to methods by which a plasma may be further heated using laser power. Also theoretically considered is the interaction of a solid or liquid pellet with a high temperature plasma. Author (GRA)

N71-16190# Mobil Research and Development Corp., Princeton, N.J. Central Research Div. Lab.

HEAVY-ION BEAM-PROBE SYSTEMS FOR PLASMA DIAGNOSTICS Final Report, 1 Dec. 1968 – 30 Nov. 1969

Robert L. Hickok and Forrest C. Jobes Jul. 1970 94 p refs

(Contract F44620-69-C-0049)

(AD-713857; AFOSR-70-2354TR) Avail: NTIS CSCL 20/9

The design and operation of a plasma diagnostic system utilizing a heavy ion beam probe to measure plasma density, space potential and current density is described. This system provides three dimensional space resolution of the order of 0.001 cm cubed, time resolution of the order of 100 microsecs and is capable of making measurements that are continuous in both space and time. Maps of the density and space potential of an energetic arc plasma show that the gross features are similar for both parameters, but that there is an excess of electrons at a radius equal to the cathode radius and an excess of positive ions inside and outside this ring. Preliminary current density measurements suggest that the main arc current is carried by a strongly localized filament of streaming electrons. Design of a 200 kev, T1 plus ion beam probe for use on the Princeton Plasma Physics Laboratory ST Tokamak is described. GRA

N71-16364# North Carolina State Univ., Raleigh. Dept. of Physics.

EQUIPMENT LOAN CONTRACT Semiannual Report, 1 Oct. 1969 – 30 Sep. 1970

Willard H. Bennett 1 Oct. 1970 5 p refs

(Contract N00014-67-C-0170)

(AD-714010) Avail: NTIS CSCL 20/9

A previous report summarized the current program and particular comments were made on the electric pinch and wave propagation parts of the program. The following is a summary of the current status of the work on instabilities in magnetically self-focusing streams in plasma. Author (GRA)

N71-16490*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

EXPERIMENTAL VERIFICATION OF THE THEORY ON WEAK TURBULENCE: INTERPRETATION OF SEQUENCE OF DIFFUSE PLASMA RESONANCE OBSERVED IN SPACE

Hiroshi Oya Jan. 1971 49 p refs Submitted for publication

(NASA-TM-X-65435; X-621-71-22) Avail: NTIS CSCL 20I

An interpretation of the sequence of diffuse plasma resonances observed by space probes Alouette 2 and ISIS-A satellites is developed in terms of wave-particle nonlinear interaction in a weakly turbulent plasma including electrostatic electron cyclotron harmonic wave instability. Observations and theory indicate that the center frequency of the diffuse plasma resonance and the center frequency of the electrostatic wave resonance satisfy the condition of the wave particle nonlinear interaction with the resonance associated with twice the electron gyrofrequency according to a given condition. The longest time durations of the center frequency resonance coincides with the most favorable condition for the electrostatic electron cyclotron harmonic wave instability which is obtained by solving the dispersion equation obtained for a linear approximation of the kinetic equation for the warm magnetoactive plasma. Author

N71-16569# Innsbruck Univ. (Austria). Inst. for Theoretical Physics.

STABILITY OF A HYDROMAGNETIC POISEUILLE FLOW (FLOWING PLASMA INSTABILITY)

Ernst H. Jager 15 Sep. 1970 24 p refs

(Contract F61052-70-C0014)

(AD-714616; UNICP-SR72; AFOSR-70-2599TR; SR-72) Avail: NTIS CSCL 20/9

The present paper deals with the stability of an incompressible plane plasma sheet flow in linear approximation. The normal mode method had shown that, in the case of homogeneous boundary conditions, inhomogeneities of the plasma can lead to instabilities. Here, the effect of a parabolic velocity is examined in the low-dissipation limit. The behavior of such a plasma sheet flow is characterized by a characteristic number in the same way as the behavior of an ordinary fluid is determined by its Reynolds number. This characteristic number is the ratio of the conservative forces to the dissipative forces. The flow is stable, when the dissipative forces are predominant. If, however, the conservative forces are predominant, then a plasma behaves unlike an ordinary fluid without a magnetic field. Author (GRA)

N71-16623# Innsbruck Univ. (Austria). Inst. for Theoretical Physics.

SUMMARY AND CONCLUDING REMARKS ON THE FOURTH EUROPEAN CONFERENCE ON CONTROLLED FUSION AND PLASMA PHYSICS

F. Herrnegger 15 Sep. 1970 23 p ref Conf. held at Rome, 31 Aug. – 4 Sep. 1970

(Contract F61052-70-C-0014)

(AD-714617; UNICP-SR73; AFOSR-70-2600TR) Avail: NTIS CSCL 20/9

The report is a summary about the papers presented at the fourth European Conference on Controlled Fusion and Plasma Physics. Some new important results on tokamaks and toroidal systems, high-beta pinches, plasma focus, nonlinear wave phenomena, multipoles and stellarators, and turbulent heating of plasmas are discussed. Author (GRA)

N71-16889# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.

HYDRODYNAMICS OF A PLASMA IN A STRONG HIGH FREQUENCY FIELD [GIDRODINAMIKA PLAZMY V SILNOM VYSOKOCHASTOTNOM POLE]

L. M. Gorbunov Sep. 1970 60 p refs Transl. into ENGLISH of Akad. Nauk SSSR, Moscow, report NP-18119

(AEC-tr-7163; NP-18119) Avail: NTIS

Processes occurring in the plasma under the influence of strong electromagnetic fields are analyzed by considering that only electrons undergo rapidly changing motion, primarily under the influence of the electrical field. The movement of the ions and consequently changes in plasma density are influenced only by the time-averaged pressure of the high frequency field. Therefore, the amplitude of the field which depends on the plasma density changes relatively more slowly than its phase. This separation of movements into rapidly changing and slowly changing allows a relatively simple system of self-consistent equations to be formulated for the hydrodynamics of a collisionless plasma in an h. f. field, which can be reduced to three equations under conditions of quasi-neutrality of the slow movement: The continuity equation, the equation of motion for the plasma considering the high-frequency pressure, and the equation for the field with slowly changing density. Author (NSA)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N71-15740# Minnesota Univ., Minneapolis. Inst. of Tech.
EXPERIMENTAL AND THEORETICAL STUDIES IN SOLID STATE AND LOW TEMPERATURE PHYSICS Annual Progress Report, 1970
Sep. 1970 48 p refs
(Contract AT(11-1)-1569)
(COO-1569-59) Avail: NTIS

Experimental studies in solid state and low temperature physics are presented. Subjects discussed are: (1) superconductors, (2) pair susceptibility of a superconductor, (3) fluctuations in superconductors near the critical temperature, (4) lifetime of persistent currents in superconducting loops, (5) elementary excitations in solid orthohydrogen, (6) pair-variational calculation of ground state properties of quantum crystals, (7) properties of liquid helium isotopes, (8) heat capacity measurements in the spin orientation region, and (9) enhanced nuclear hyperfine cooling. Author

N71-15756# Bhabha Atomic Research Centre, Bombay (India).
EXPERIMENTAL REEVALUATION OF TWO-CRYSTAL SCANNING GEOMETRY FOR WHOLE-BODY COUNTING WITH LOG-SHAPE PLACEMENT OF CRYSTALS
R. K. Hukkoo and R. C. Sharma 1970 11 p refs
(BARC-498) Avail: AEC Depository Libraries

Two-crystal scanning geometry for whole body counting is experimentally re-evaluated with the log-shape placement of a squat cylindrical crystal detector. Data on the response of this geometry for various modes of movement of a Cs(137) point source inside a phantom are presented. It is found that the present geometry yields smaller deviation in the counting efficiency as compared to the values cited by Chhabra for Naversten's geometry. It is concluded that the use of variable scan speed recommended to improve the response of two-crystal scanning geometry using squat cylindrical crystals with vertical axis may be dispensed with when the suggested placement of detectors is chosen. Author (NSA)

N71-15767# Cornell Univ., Ithaca, N.Y. Materials Science Center.
FLUCTUATIONS NEAR THE ONSET OF THE RESISTIVE TRANSITION IN FILAMENTARY SUPERCONDUCTORS
J. E. Lukens, R. J. Warburton, and W. W. Webb 19 Aug. 1970 7 p refs Sponsored by AEC
(NYO-3029-44; Rept-1437) Avail: NTIS

Measurements of the onset of the resistive transition and the current–voltage characteristics of "one-dimensional" single crystal tin whiskers, extended to a sensitivity of 10 to the minus 15th power volts, have directly revealed the predicted thermally activated quantum phase slips of magnitude 2 pi and have verified a theory for the rate of phase slippage based on the Ginsburg–Landau equations. Author (NSA)

N71-15768# Georgetown Univ., Washington, D.C.
SUPERCONDUCTIVE TUNNELING INTO BULK GALLIUM SINGLE CRYSTALS
Jamieson Charles Keister (Ph.D. Thesis) May 1970 107 p refs
(Contract AT(40-1)-3665)
(TID-25549) Avail: NTIS

Characteristic Giaever tunneling curves were obtained with high-impedance bulk gallium tunneling samples, yielding estimates of the alpha-phase gallium energy gap consistent with estimates obtained by others. Other effects, such as sample-aging processes, excess tunneling currents, weak-link behavior, and possible multiple-gap structure were observed. A fabrication process for tunnel junctions was developed that may be extended to other materials. The general problem of interpreting bulk tunneling data must be worked out before a great deal of credence can be placed on the variation of the energy gap as a function of specific crystal orientation. Further efforts to improve fabrication processes, lower sample impedances, improve temperature measuring techniques, and lower the measuring temperatures are necessary before obtaining extensive data on energy gap as a function of crystal orientation for bulk gallium. Author (NSA)

N71-15865*# Massachusetts Inst. of Tech., Cambridge. Francis Bitter National Magnet Lab.
A STUDY OF FLUX QUANTIZATION Final Technical Report
R. Meservey 31 Mar. 1970 68 p refs
(Contract NAS12-101)
(NASA-CR-116132) Avail: NTIS CSCL 20L

Basic measurements of the phenomena of flux quantization in superconductors were made. A vacuum evaporation laboratory was set up to produce thin film microcylinders of indium and aluminum. The phase boundary was measured in a parallel magnetic field and as a function of the field angle. A magnetometer and prototype ammeter were built. The magnetometer could detect 10 n gauss, but it was concluded that a thin film bridge detector design was essential for reproducible operation. It was concluded that with careful design and calibration the ammeter could measure a current or a magnetic field to an accuracy approaching one part in a million. Measurements were made of the absolute value of the penetration depth in thin films of Sn and Pb. The temperature dependence of the penetration depth of aluminum was measured with a pure annealed aluminum wire and found not to agree closely with BCS theory. The kinetic inductance was measured quantitatively in thin films and wires of Sn and found to agree rather accurately with theoretical predictions. Sensitive transducers of temperature, magnetic field, and current density were developed using a digital inductance meter. This inductance meter was also used with a paramagnetic salt to give a digital thermometer. Author

N71-15867# General Electric Co., Philadelphia, Pa. Missile and Space Div.
RESEARCH ON AVALANCHE TYPE SEMICONDUCTOR RADIATION DETECTORS Semiannual Report, Jan.–Jun. 1970
Philip J. Moldofsky and Peter V. Hawks Jul. 1970 69 p refs
(Contract AT(30-1)-3246)
(NYO-3246-TA-7) Avail: NTIS

Seven esophageal probes have been produced in a continuing feedback-development. Based on the first animal studies performed with the avalanche detector, several probes were fashioned to achieve a probe with a lower in vivo minimum detectable amount (MDA) than previous detectors. The latest in this series exhibits an MDA of 25 nCi of plutonium in the biological geometry presently assumed, i.e., plutonium filtered into the bronchial and metastinal lymph nodes. A charge-sensitive preamplifier has been integrated into the standard AEC-sponsored detection instrument, providing greater electronic sensitivity than was available previously, and allowing use of detectors with greater area and detector probes on long cables. Author (NSA)

N71-15877# Arizona State Univ., Tempe.
SOLID STATE CHEMISTRY OF RARE EARTH OXIDES Technical Progress Report, 1969–1970

LeRoy Eyring, Theron L. Felmlee, Donald L. Fox, John M. Haschke, and Arthur T. Lowe 1 Jul. 1970 96 p refs
(Contract AT(11-1)-1109)
(COO-1109-52) Avail: NTIS

Progress is reported on the solid state chemistry of rare earth oxides in the areas of hydrothermal crystal growth, phase relationships in the rare earth oxides, heterogeneous isotope exchange studies, the ternary UzPryOx system, and the rare earth formates. NSA

N71-15878# California Univ., Livermore. Lawrence Radiation Lab.
DYNAMIC YIELD STRENGTHS OF LIGHT ARMOR MATERIALS
W. H. Gust and E. B. Royce 1 Jul. 1970 25 p refs
(UCRL-50901) Avail: NTIS

Inclined mirrors and prisms have been used to determine Hugoniot elastic limits (HEL's) for the light ceramics B4C, BeO, four grades of Al2O3, SiC, TiB2, Al B12, TiBe12, Be2B, and ZrBe13; ⟨100⟩, ⟨110⟩, and ⟨111⟩ Si; and a maraging steel, Vascomax 350. Hugoniot parameters to about 1 Mbar were measured for B4C, BeO, and the four aluminas and to about 0.5 Mbar for Si. Four-wave shock structures were observed for ⟨110⟩ and ⟨111⟩ Si. These have been related to HEL's and to two successive phase transitions. In Vascomax 350, a three-wave structure was seen which appears to be related to the 130-kbar transition in Fe. Three-wave structures were also observed in ⟨100⟩ Si and AlB12. Author (NSA)

N71-15882# Postmaster-Generals Dept., Melbourne (Australia). Research Labs.
EQUIPMENT FOR ZONE MELTING InSb FILMS USING A HOT WIRE Research Report, Nov. 1967 - Jan. 1969
W. J. Williamson Sep. 1969 15 p refs
(NP-18456; Rept-6420) Avail: AEC Depository Libraries

Equipment for zone melting thin films of InSb is described, using hot wire as the heat source. Experimental results are presented, which show that single phase InSb films can be prepared using this equipment. Author (NSA)

N71-15892*# John Carroll Univ., Cleveland, Ohio.
ULTRASONIC ATTENUATION AND VELOCITY MEASUREMENTS IN THE NORMAL AND SUPERCONDUCTING STATES OF NIOBIUM
J. Trivisonno, J. Washick, M. J. Keck, R. Reifenberger, and T Slotwinski Washington NASA Jan. 1971 87 p refs
(Grant NGR-36-006-003)
(NASA-CR-1742) Avail: NTIS CSCL 20L

Ultrasonic attenuation measurements in niobium single crystals at frequencies from 50 to 810 MHz over the temperature range 3.0 to 11.0 K are presented. The attenuation in superconducting niobium is found to differ from the behavior predicted for both longitudinal and transverse modes. A ql dependence is found for longitudinal waves but not for transverse waves. Ultrasonic measurements in the mixed state of niobium as a function of orientation are presented. The mixed state attenuation of longitudinal and transverse waves is found to be in qualitative agreement with the predictions of the Maki-Kinder theory. A system used to measure changes in the ultrasonic velocity with a sensitivity of 1 part in 10 to the 7th power is presented. Changes in the velocity of longitudinal and transverse waves at 10 MHz over the temperature range 3.0 to 11 K are given. Author

N71-15893# Marquette Univ., Milwaukee, Wis. Coll. of Engineering.
ELECTRICAL CONDUCTIVITY OF SINGLE-CRYSTAL CERIUM DIOXIDE
F. S. Brugner and R. N. Blumenthal [1970] 4 p refs
(Contract AT(11-1)-1441)
(COO-1441-11) Avail: NTIS

The electric conductivity of a CeO2 single crystal was measured as a function of temperature (1200 to 1500 C) and oxygen pressure (1 to 10 to the −13th power atm). The data show excellent agreement with normalized conductivity values for 70 and 85% dense sintered specimens; below 1200 C, impurities in the single crystal begin to influence the conductivity. NSA

N71-15917*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
QUANTUM GALVANOMAGNETIC AND THERMOMAGNETIC EFFECTS IN GRAPHITE TO 18.3 TESLAS (180 kG) AT LOW TEMPERATURES
John A. Woollam Washington Jan. 1971 34 p refs
(NASA-TN-D-7037; E-5696) Avail: NTIS CSCL 20L

The magnetoresistance, Hall effect, thermopower, thermal resistivity, and Nernst-Ettingshausen effects are measured in magnetic fields to 18.3 tesla (183 kG) and at temperatures between 1.1 and 4.2 K. Samples are highly ordered pressure annealed pyrolytic graphite. The major results are the assignment of majority carrier electrons and holes to specific locations in the Brillouin zone, the first observation of spin-split Landau levels, a study of distorted line shapes of thermopower quantum oscillations, and a test of Sugihara and Ono theory for Landau level crossings of the Fermi energy in graphite. Author

N71-16004# Marquette Univ., Milwaukee, Wis. Coll. of Engineering.
A STUDY OF THE DEFECT STRUCTURE OF NONSTOICHIOMETRIC CeO2 Technical Progress Report
Robert N. Blumenthal Sep. 1970 23 p refs
(Contract AT(11-1)-1441)
(COO-1441-12) Avail: NTIS

The electrical conductivity of a single crystal of Ce1+y O2 has been measured as a function of temperature and oxygen pressure. For comparative purposes the conductivity data obtained on sintered specimens has been normalized for porosity using the relation sigma (normalized) = sigma (measured) (rho (theoretical)/rho measured)). The agreement between the normalized conductivity values and the single-crystal data in the temperature range 1200−1500 C was excellent. The electrical conductivity of sintered specimens of CaO-doped CeO2 have also been measured as a function of temperature and oxygen pressure. Author (NSA)

N71-16005# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF IRRADIATION WITH A HIGH-POWER ELECTRON BEAM ON THE STRUCTURE AND MICROHARDNESS OF A SILICON SINGLE CRYSTAL
V. P. Alekhin et al 27 Aug. 1970 12 p refs Transl. into ENGLISH from Fiz. Khim. Obrabotki Materialov (USSR), no. 6, 1969 p 123−126
(AD-714742; FTD-HT-23-525-70) Avail: NTIS CSCL 20/12

Irradiation of (110) plane of an n-Si single crystal with an electron beam of about 10 (superscript 7) W/cm (superscript 2) resulted in 3 types of deformation. The dislocation d. (Rho) in the 2nd and 3rd regions was about 10 (superscript 7) and is greater than 10, superscript 8/cm (superscript 2). The single-crystal state did not change in any of the 3 regions. The microhardness H (subscript v) changed sharply on annealing at 300 degrees. Annealing at 600 degrees removed all strain, but H (subscript v) did not increase above 1000 kg/mm (superscript 2). The increase of Rho of different specimens is assocd. with the decrease in H (subscript v). Author (GRA)

N71-16016# Hughes Research Labs., Malibu, Calif.
RESEARCH AND DEVELOPMENT ON SINGLE CRYSTAL HIGH RESISTIVITY CADMIUM TELLURIDE FOR USE AS A GAMMA-RAY SPECTROMETER Annual Summary Report, 1 Jan. – 31 Dec. 1969
Kenneth R. Zanio Aug. 1970 53 p refs
(Contract AT(04-3)-549)
(SAN-549-6) Avail: NTIS

Single crystals of semiinsulating CdTe were grown from the melt and vapor for spectroscopy purposes. Melt-grown crystals were found to resolve photoevents from monoenergetic gamma emitters having a 10% spread in photon energy. These photopeaks were obtained at reduced biases to provide electron transport at approximately 50% charge collection efficiency. Photopeaks obtained with this melt-grown material at higher biases gave poorer resolution due to fluctuations in hole drift lengths or insdequate magnitude of the hole drift lengths. Detectors made from vapor-grown crystals resolve alpha particles with 1.5% resolution at 95% charge collection efficiency for electrons. With vapor-grown crystals, photopeaks have been obtained due to both electron and hole transport at 80% total charge collection efficiency.
Author (NSA)

N71-16017# Texas Instruments, Inc., Dallas.
DEFECTS AND THEIR ROLE IN DETERMINING BULK PROPERTIES OF CRYSTALS Final Report
William C. Holton Sep. 1970 26 p refs
(Contract F44620-67-C-0073)
(AD-714620; AFOSR-70-2420TR) Avail: NTIS CSCL 20/12

The luminescence and electrical properties of doped II-VI compounds have been related to the presence of specific impurity centers by identifying the center through its characteristic paramagnetic resonance and correlating resonance intensity with optical/electrical properties. Because the Jahn-Teller effect is found to occur for many of these impurity defects, it has been studied in simplified situations. Sc(2+) (3d1) in CdF2 and O(-) (2p5) in KI. Self-activated, copper, rare-earth, transition metal, and Group V centers are among the impurities studied. P-type ZnSe was produced by P and As doping. Sharp line rare earth fluorescence is excited via energy transfer in a (rare earth)(3+) -4Cu(+) complex.
Author (GRA)

N71-16037* Tyco Labs., Inc., Waltham, Mass
SEGMENTING LEAD TELLURIDE-SILICON GERMANIUM THERMOELEMENTS Patent
Martin Weinstein, Herbert E. Bates, and Joseph Epstein, inventors (to NASA) Issued 1 Jul. 1969 (Filed 30 Sep. 1966) 5 p Cl. 29-472.9; Int. Cl. H01l7/04, 7/16 Sponsored by NASA
(NASA-Case-XGS-05718; US-Patent-3,452,423;
US-Patent-Appl-SN-584071) Avail: US Patent Office CSCL 20L

A method of segmenting different thermoelectric materials to achieve a composite element effective over a wide temperature range is presented. A segmented thermoelectric electrode is produced by first thoroughly cleaning two thermoelectric elements of different but complementary temperature ranges, holding the elements in intimate contact in a bonding fixture, and heating the elements in a suitable furnace for a preselected time within a certain temperature range.
NASA

N71-16038# California Univ., Berkeley. Dept. of Physics.
ELECTRONIC STRUCTURE OF METALS Final Report
Arthur F. Kip 25 Jun. 1970 8 p refs
(Grant AF-AFOSR-1352-66)
(AD-714104; AFOSR-70-1825TR) Avail: NTIS CSCL 20/12

The principal works covered are as follows: Further work on cyclotron resonance and electron relaxation times in copper; A new technique for the study of resistivity in metals, using the eddy-current decay method; An automatic electropolisher for copper; New studies of cyclotron resonance in zinc, including the temperature dependence of the effective mass in zinc; An investigation of cyclotron resonance in cadmium; The noise spectrum of flux jumps in Type II superconductors; and, Electron resonance relaxation times in bulk sodium.
Author (GRA)

N71-16072# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COERCIVE FORCE OF TWO-LAYER FILMS
V. V. Zvyagintsev 25 Aug. 1970 15 p refs Transl. into ENGLISH from Fiz.-Tekhnol. Vopr. Kibernetiki (USSR), no. 1, 1968 p 161 – 171
(AD-714433; FTD-MT-24-143-70) Avail: NTIS CSCL 20/3

The coercive force of thin magnetic films consisting of 2 nonmagnetostrictive layers, 1 layer NiFe, the 2nd layer FeCo or NiFeCo, is studied. The coercive force, H (subscript c), of 2-layer NiFe-CoFe films grows linearly with the growth of the angular dispersion of anisotropy, alpha 90, as in single-layer films (growth of alpha 90 was reached by increasing the thickness of the CoFe layer). The dependence of H (subscript c) of NiFe-NiFeCo films on the thickness of a layer of d (subscript 2) of NiFeCo is also studied. With the growth of d (subscript 2) from zero to 400-500 A., H (subscript c) grows in connection with the fact that the presence of the satn. magnetization of the materials (J (subscript 2) is greater than J (subscript 1)) leads to the formation of addnl. poles in domain boundaries, i.e., increases the total energy of the boundaries. When d (subscript 2) is greater than 500 A., the addnl. magnetostatic energy of a boundary decreases and the growth of H (subscript c) diminishes. Theoretically obtained curves of d (subscript 2) dependence of energy and the width of domain boundaries are presented. The calculated value of d (subscript 2) in the presence of the max. value of H (subscript c) is in keeping with the exptl. obtained value.
Author (GRA)

N71-16111# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Physics.
MAGNETIC ORDERING IN CsMnCl3 2H2O
S. A. Friedberg, J. Skalyo, Jr. (Brookhaven Natl. Lab.), G. Shirane (Brookhaven Natl. Lab.), H. Kobayashi (Kyoto Univ.), and I. Tsujikawa (Kyoto Univ.) 15 Oct. 1970 9 p refs Submitted for publication
(Contract N00014-67-A-0314-0006)
(AD-714515; TR-3) Avail: NTIS CSCL 20/3

Neutron scattering and magnetic susceptibility experiments are reported for single crystal CsMnCl3.2H2O and CsMnCl3.2D2O at low temperatures. Direct proof is given of linear chain antiferromagnetic spin ordering in these salts. The ordering process is followed in detail. The data yield intra- and interchain spin coupling constants and correlation lengths, anisotropy field, Neel temperature, critical magnetization index, and ordered spin configuration.
Author (GRA)

N71-16112# Army Foreign Science and Technology Center, Washington, D.C.
SOLID STATE PHYSICS
Yu. L. Koptev 25 Sep. 1970 30 p Transl. into ENGLISH from Fiz. Tverdogo Tela (Leningrad), 1968 p 3 – 20
(AD-713923; FSTC-HT-23-521-70) Avail: NTIS CSCL 20/12

The work presents a summary of investigations conducted by various researchers in the field of solid state physics. Of key interest are: mechanical properties of solids, relaxation processes in polymers, studies on properties of crystals, deformation and rupture investigations and properties of rigid superconductors.
Author (GRA)

N71-16189# Stanford Univ., Calif. Electronics Labs.
EFFECTS OF GAMMA RADIATION ON GALLIUM ARSENIDE CRYSTALS AND GUNN DIODES
Gailon E. Brehm Aug. 1970 89 p refs
(Contract DAH0004-69-C-0011)
(AD-714684; SU-SEL-70-049; AROD-2895-32-E; TR-5121-1) Avail: NTIS CSCL 20/12

Electrical and photoluminescence measurements have been made on liquid epitaxial gallium arsenide irradiated at room temperature by 1.25 MeV Co-60 gamma rays. Both n- and p- type crystals with initial free carrier densities of 4 X 10 to the 15th power/cubic cm were subjected to a series of irradiations after each of which Hall measurements were made as a function of temperature from 77 to 300K. Photoluminescence measurements were made on irradiated and unirradiated crystals. Hall measurements on n-type crystals indicate the presence of imperfections having energy 0.13, 0.16 and 0.30 eV below the conductions band minimum in irradiated GaAs. The 0.13 and 0.16 eV levels are introduced during irradiation at roughly 1/2 the rate at which the compensating deep acceptors are introduced. New photoluminescence peaks detected in both n- and p-type crystals indicate energy levels near the center of the band gap which may also be produced by irradiation. Hall measurements on p-type crystals indicate the presence of imperfections having energy levels 0.059 and 0.10 eV above the valence band maximum in irradiated GaAs. The Hall measurements made on these crystals before irradiation indicate the presence of impurities having energy levels in the lower 0.20 eV of the band gap. Author (GRA)

N71-16193# Westinghouse Research Labs., Pittsburgh, Pa.
SPIN-RELAXATION STUDIES OF PARAMAGNETIC DEFECTS IN 2-6 CRYSTALS Final Report, 1 Feb. 1966-1 Feb. 1970
George R. Wagner, Joseph Murphy, and John G. Castle, Jr. Jun. 1970 157 p refs
(Contract AF 33(615)-3579)
(AD-713864; ARL-70-0108) Avail: NTIS CSCL 20/12

Spin-lattice relaxation studies were carried out on the substitutional impurities Cr(2+), Co(2+), and Mn(2+) in single crystals of wurtzite cadmium sulphide; on the substitutional impurity Mn(2+) in single crystals of cubic zinc sulphide; and on two paramagnetic centers in a single crystal of wurtzite cadmium sulphide which was enriched in 114Cd. All the crystals except the 114CdS were co-doped with lithium. The results have been interpreted for each case in terms of theoretical models for the defect centers and their interaction with their surroundings. The two centers in 114CdS have been tentatively identified. Calculations of the Jahn-Teller effect and the Ham effect for CdS:Cr(2+) have been performed and the results used to interpret the previously reported ESR properties and the results of the spin-lattice interaction studies reported here. Preliminary investigations of the effect of band-gap irradiation on the spin-relaxation of CdS:Mn(2+) are reported. Author (GRA)

N71-16216# Wisconsin Univ., Madison. Dept. of Physics.
SURFACE STUDIES BY LOW-ENERGY ELECTRON DIFFRACTION Final Report
Maurice B. Webb Oct. 1970 11 p refs
(Grant AF-AFOSR-1677-69)
(AD-714691; AFOSR-70-2503TR) Avail: NTIS CSCL 7/4

Low-energy electron diffraction offers the potential for surface crystallography analogous to x-ray and neutron studies of the bulk. This potential has not been fully realized because of the strong interactions, both elastic and inelastic, between the electron and the crystal. The report summarizes experiments done in an effort to achieve sufficient understanding of the diffraction to realize this potential. Studies on the scattering from Ni at high temperatures and from liquid Hg established that: (1) the atomic scattering factor for backward scattering is essentially the same for free atoms and those in the condensed phase; (2) multiple scattering processes are strongly attenuated by inelastic processes; (3) roughly half the elastically back scattered electrons have interacted only once; (4) penetration depths are the order of 1-3 atomic spacings. Other studies establish quantitatively a two step process for the inelastic scattering for small energy losses and allow determination of the loss function and show that the surface loss contributions are dominant. Careful studies as a function of T and all the diffraction variables have determined detailed properties of the elastic scattering from Ag(111) and Ni(111) including the azimuthal symmetry, Debye Waller factors as a function of energy, effective thermal expansion. Author (GRA)

N71-16302# Office of Naval Research, London (England).
SUMMER SCHOOL ON ELECTRICAL PROPERTIES OF NONCRYSTALLINE MATERIALS
Robert G. Morris 16 Sep. 1970 17 p Conf. held at Cambridge, England, 29 Jun.-3 Jul. 1970
(AD-713940; ONRL-C-23-70) Avail: NTIS CSCL 20/12

A Summer School on electrical Properties of Noncrystalline Materials was held at Cambridge University, England 29 June to 3 July 1970. There were over 115 participants from over a dozen countries. Prof. Sir Nevill Mott, Director of the Cavendish Laboratory at Cambridge organized the meeting in order that the theoretical and experimental results in the field could be reviewed. Author (GRA)

N71-16303# Boeing Co., Renton, Wash. Commercial Airplane Div.
QUANTITATIVE PHASE ANALYSIS AND PRECISE LATTICE PARAMETER MEASUREMENTS BY X-RAY DIFFRACTION
R. H. Olsen 23 Sep. 1970 37 p refs
(AD-713910; D6-25253) Avail: NTIS CSCL 20/2

The technique developed for quantitative phase analysis involves using the siemens X-Ray Diffractometer and specially designed specimen holder which tilts and rotates the specimen while the intensity profiles from particular diffraction planes are recorded. The intensity profiles are recorded on printed tape and input, along with phase chemistries and crystallographic data, to a computer program XRAY that calculates the necessary intensity factors, integrates the intensity profiles and calculates the volume fraction. Standard methods for retained austenite, and beta analysis in titanium were developed. The procedure for calculating lattice parameters is based on Cohens method of Least Squares analysis. Measured diffraction angles and the corresponding wavelength and hkl are input to computer program XRLP. Author (GRA)

N71-16304# Rochester Univ., N.Y. Dept. of Physics and Astronomy.
THEORY OF ELECTRONIC PROPERTIES OF SOLIDS Final Report, 1 Jun. 1967-30 Jun. 1970
D. L. Dexter and R. S. Knox 30 Sep. 1970 11 p refs
(Grant AF-AFOSR-0611-67)
(AD-714099; AFOSR-70-2455TR) Avail: NTIS CSCL 20/12

In the field of electronic properties of normal metals there has been the work of Gaspari and Shyu and in superconducting metals that of Guertin et al. and Bennemann et al. Knox and co-workers have made contributions to the theory of the optical and electronic properties of crystalline and amorphous organic matter. Atomic and band structure calculations have been made by Reilly, Knox, Miyakawa et al. Formal optical and lattice dynamical calculations have been carried out by Dexter, Benin and Miyakawa. Work on excitons has also been performed by these authors Dexter, Knox and Miyakawa. Several papers by Dexter and Miyakwa have appeared on the theory of electronic bubbles in cryogenic liquids and Dexter, and Miyakawa et al. have worked on problems

involving the electron phonon interaction in optical transitions. Bhargava and Dexter have calculated the optical properties of substitutional impurities in solid argon and neon and Dexter, Knox, and Miyakawa have worked on several problems involving energy transfer in condensed matter. Author (GRA)

N71-16323# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FORMS OF PRIMARY CRYSTALLIZATION OF CERTAIN INTERMETALLIC COMPOUNDS
R. R. Malinovskii et al 2 Sep. 1970 21 p refs Transl. into ENGLISH from Tr. Mosk. Aviats. Tekhnol. Inst. (Moscow), no. 70, 1969 p 14-27
(AD-714420; FTD-HT-23-386-70) Avail: NTIS CSCL 20/2

A study was made of forms of primary crystals of several aluminides of transition metals in aluminum alloys and certain of their properties (Microhardness). Analyzed was the mechanism of growth of crystals from a melt and the role of cooling rates. Determined was the dendritic character of growth of the majority of analyzed aluminide crystals. Author (GRA)

N71-16324# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLID STATE RESEARCH Quarterly Technical Summary Report, 1 May-30 Jul. 1970
Alan L. McWhorter 15 Aug. 1970 72 p refs
(Contract AF 19(628)-5167)
(AD-714079; ESD-TR-70-234) Avail: NTIS CSCL 20/12

The report covers in detail the solid state research work of the Solid State Division at Lincoln Laboratory for the period 1 May through 31 July 1970. The topics covered are Solid State Device Research, Materials Research, Physics of Solids, and Microelectronics. The Microsound work is sponsored by ABMDA and is reported under that program. Author (GRA)

N71-16361# Army Materials and Mechanics Research Center, Watertown, Mass. Metals Div.
GRAIN BOUNDARY FACETING OF (10-10) TILT BOUNDARIES IN ZINC
George H. Bishop, Jr. William H. Hartt, III, and Gordon A. Bruggeman Sep. 1970 29 p refs
(AD-714227; AMMRC-TR-70-28) Avail: NTIS CSCL 20/2

Faceted high-angle tilt grain boundaries have been observed in <10-10> zinc bicrystals and tricrystals grown from the melt. Faceting occurs over a 5-1/2 degrees range of misorientations for tilt angles between 31 and 36.5 degrees. The facets, which are asymmetric <10-10> tilt boundaries, are singular interfaces corresponding to energy cusps in the gamma-plot of grain boundary energy versus the inclination of the boundary surface. Limiting values of the depth of the energy cusps giving rise to the facets, and of the surface torques acting on the facets, are presented. The conditions for, and the mechanisms of facet formation are discussed. Author (GRA)

N71-16363# Chicago Univ., Ill.
THE ELECTRON THEORY OF SOLIDS. THE ELECTRON THEORY OF CONDENSED MATTER AND OF THEORETICAL BIOLOGY Final Reports, 1 Oct. 1960-30 Sep. 1970
Morrel H. Cohen 30 Sep. 1970 16 p refs
(Contracts Nonr-2121(22); N00014-67-A-0285-0011)
(AD-714285) Avail: NTIS CSCL 20/12

The report lists the manuscripts submitted or published under the contract, mainly in areas of solid state physics. GRA

N71-16440# California Univ., Berkeley. Lawrence Radiation Lab. Inorganic Materials Research Div.
DIFFUSION STUDIES IN THE ALUMINA-SILICA SYSTEM
Robert Foster Davis (Ph.D. Thesis) Jul. 1970 115 p refs
(Contract W-7405-eng-48)
(UCRL-19644) Avail: NTIS

The diffusion kinetics and phase equilibria between silica and sapphire or mullite couples annealed in helium and air were investigated with particular emphasis placed on the relationships between atomistic mechanisms and structural changes. Dissolution occurred in the SiO2-rich liquid accompanied by the formation of a detectable mullite solid solution (sapphire-silica couples) above 1634 C. The mullite liquid interfacial compositions formed a revised liquidus curve between the melting point of mullite and the mullite-silica eutectic. The growth of mullite is dependent upon the relative dissolution rates of mullite in the liquid. The diffusivities of the aluminum ion vary greatly with concentration and temperature. As a result, Q and D sub 0 values are very high at low aluminum concentrations and decrease as Al2O3 is taken into the glass. Author

N71-16441# California Univ., Berkeley. Lawrence Radiation Lab.
CHARACTERIZATION OF SINTERING PHENOMENA OF (Na(0.5)K(0.5))NbO3
Wolfgang Stannek (M.S. Thesis) Jul. 1970 72 p refs
(Contract W-7405-eng-48)
(UCRL-19668) Avail: NTIS

Investigations of sintering behavior, densification and grain growth of pure and barium-doped sodium-potassium niobate were made in an oxygen atmosphere at several temperatures. Calcining conditions were optimized in preceding experiments. X-ray diffraction, microprobe analysis, weight loss data, scanning electron microscope and sintering data were used to characterize this compound. A decrease in density accompanied by large grain growth and an increase in pore size were observed. Examinations employing a scanning electron microscope revealed a microstructure consisting of well marked cubical grains. Ba(2+) doped into the material in several amounts appeared to be a powerful grain growth inhibitor in this system. It is postulated that the low surface energy at the (100) planes of sodium-potassium niobates is responsible for the difficulties in conventional processing of these materials. Author

N71-16449# Hughes Research Labs., Malibu, Calif.
CADMIUM TELLURIDE MODULATOR MATERIAL Interim Technical Report, 1 May-31 Oct. 1970
A. L. Gentile, N. R. Kyle, and J. E. Kiefer Nov. 1970 39 p refs
(Contract N00014-70-C-0303)
(AD-714284) Avail: NTIS CSCL 20/2

The growth of single crystal CdTe by a modified Bridgman technique is being investigated to improve the material for use in infrared modulator devices. A systematic variation of selected crystal growth parameters together with quench and post-growth anneal parameters is being carried out to accomplish this goal. Of primary importance are those growth parameters which relate to removal of heat from the growing crystal. The use of a conductive metal heat-sink at the tip of the growing crystal combined with a specific growth rate and temperature gradient has shown significant improvement in crystallinity yielding modulator rods of 0.5 x 0.5 x 2.5 cm dimensions. High resistivity single crystal material with low absorption has been obtained both as grown and thermally annealed following growth. Author (GRA)

N71-16473# Northern Illinois Univ., Dekalb. Dept. of Physics.
ELECTRICAL AND OPTICAL PROPERTIES OF AMORPHOUS MATERIALS Semiannual Technical Report
Charles Wood [1970] 61 p refs
(GRANT DA-ARO(D)-31-124-70-G77; ARPA Order 1562)
(AD-714029) Avail: NTIS CSCL 20/12

A very significant finding was that the standard method of preparing the amorphous forms of the Group V-VI compounds by vacuum evaporation from the compound is very unreliable from the compositional viewpoint. It appears probable that no data has ever been reported on truly Sb2Se3 amorphous films, despite considerable literature on the subject. Several approaches have been taken, or are under development, which have yielded amorphous Sb2Se3 films. Initial Mossbauer studies have shown that the Sb atoms in amorphous SbxSey ($x < 2$, $y > 3$) films differ in environment from the single crystal form and therefore appear to be amorphous rather than microcrystalline. Kramers-Kronig analysis of optical reflectivity data has been used extensively to analyze optical reflectivity data on single crystals and thin films. Highlights in the optical studies to date are: the band gap in Sb2Se3 appears to be due to a direct transition; plasma resonance frequencies can be accurately determined by thermoreflectance data; photon counter techniques show great promise in determining the critical points in band structure. Author (GRA)

N71-16474*# Kentucky Univ., Lexington. Dept. of Metallurgical Engineering and Materials Science.
RESEARCH STUDY OF STRUCTURAL DAMAGE PRODUCED IN SILICON SEMICONDUCTORS BY NEUTRON IRRADIATION Final Report, Jun. 1969 – Jul. 1970
Gordon A. Sargent Jul. 1970 40 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952561)
(NASA-CR-116181; UKY-31-70-MET-13) Avail: NTIS CSCL 20L

The size distribution, morphology, and structural characteristics of the regions of lattice disorder which are produced by bombarding undoped and lithium doped silicon solar cells with neutrons are discussed. The research has been carried out entirely on the electron microscope using the techniques of surface replication, electron transmission, and electron diffraction. Evidence for the presence of precipitated metallic lithium was found in all the doped float zone melted samples and there was some indication of an oxide precipitate in the pulled samples. Crater defects which were thought to be associated with the space charge region around vacancy clusters were observed in all of the samples of the irradiated float zone material. Similar defects were only observed in the most heavily doped and irradiated crucible pulled material. It was concluded that the presence of oxygen in the pulled material may be an efficient trap which prevents the formation of the large defect clusters. Author

N71-16475# Harry Diamond Labs., Washington, D.C.
THE FITTING OF EXPERIMENTAL DATA TO A PARAMETRIZED THEORY
N. Karayianis and D. E. Wortman May 1970 31 p refs
(AD-714199; HDL-TR-1498) Avail: NTIS CSCL 14/2

A general discussion is given of the problem of fitting experimental data with a parametrized theory. The usefulness in this connection of a computer program, called HOME, is discussed and examples are given. This program was developed and has been successfully applied to a wide variety of problems. Author (GRA)

N71-16530# Boston Univ., Mass. Dept. of Physics.
SINGLE CRYSTAL MOESSBAUER SCATTERING Final Report, Sep. 1968 – Sep. 1970
Kanchan P. Singh, Peter Van den Beemt, and Gilbert R. Hoy Sep. 1970 68 p refs
(Contract F19628-69-C-0002)
(AD-714573; AFCRL-70-0547) Avail: NTIS CSCL 20/2

The work enhances the applicability of Mossbauer spectroscopy on single crystal specimens. Measurements were made on the following samples; Fe foils, alpha-Fe2O3 powder, Fe powder and single crystals of sodium nitroprusside. Experiments on these samples were done using both the 14 keV gamma-ray and the 6 keV x-ray in scattering geometry. Aside from the effects of sample thickness, the 6 keV scattering results are the same as the ordinary transmission results. In finding the intensity ratios of spectral lines in the same spectrum, it is important to include thickness effects. Each line has associated with it, its own effective thickness. This phenomenon is explained. It is shown that scattering results can be used to obtain the effective field parameters if single crystals of thickness effects are included and carefully grown and cut crystals are used. A computational procedure is presented that is particularly suited to single crystal work. Author (GRA)

N71-16597# National Bureau of Standards, Washington, D.C. Inorganic Materials Div.
ARPA-NBS PROGRAM OF RESEARCH ON HIGH TEMPERATURE MATERIALS AND LASER MATERIALS, 1 JANUARY – 30 JUNE 1970
A. D. Franklin and Herbert S. Bennett, eds. Jan. 1971 83 p refs
(ARPA Order 373-62)
(NBS-TN-565) Avail: SOD $0.75

Several problems in the areas of high temperature materials and laser materials are discussed. Under the high temperature materials extremely pure Al2O3 crystals have been prepared and analysed chemically with the aim of providing specimens for research on mass transport, electronic, and similar properties. Oxygen diffusion data on TiO2, obtained by the gas uptake method, agree with literature values, and work is now proceeding on developing a sectioning technique for oxygen diffusion. The optical constants of titanium have been determined over the visible portion of the spectrum. Soft X-ray spectra, nmr data, Mossbauer spectra, magnetic susceptibility, and other probes of the electronic density of states have been determined for a group of diborides of the first-series transition metals (Sc, Ti, V, Cr, and Mn) and interpreted in terms of the d-electron contribution to the density of states near the Fermi level. Both this project and the previous one on the optical properties of titanium have been completed. Under laser materials, the measurement of bulk optical properties and chemical analyses of ruby and Nd-glass are complete. Author

N71-16618# Litton Precision Products, Inc., Morris Plains, N.J. Airtron Div.
RESEARCH ON ZIRCON POLARIZERS Quarterly Report, Jul. – Sep. 1970
Rodger F. Belt, Richard C. Puttbach, and Ramanathan Dharmarajan 30 Oct. 1970 50 p refs
(Contract N00014-70-C-0379)
(AD-714525; R11-590; QR-1) Avail: NTIS CSCL 20/2

Attempts to grow single crystals of zircon ($ZrSiO_4$) by molten salt and hydrothermal techniques are described. Crystals grown from a lithium vanadate melt were colored in various shades of blue due to small amounts of V+4 impurities. Colorless microcrystallites were obtained from open molybdate flux runs. Hydrothermal zircon growth feasibility was established in 3M KF mineralizer at 575 to 600C and 30,000 p.s.i. Other efforts were directed toward: (i) Obtaining accurate zircon solubility data in MoO_3, PbO, and PbF_2 type fluxes, (ii) Sintering of SiO_2 and ZrO_2 to obtain a suitable hydrothermal nutrient and (iii) Determination of pressure-temperature growth realms of ZrF_4, HF, and KHF_2 mineralizers. Author (GRA)

N71-16700# Centro Informazioni Studi Esperienze, Milan (Italy).
VACANCY-IMPURITY ATOM INTERACTION IN NOBLE METALS AND THEIR ALLOYS; DEPENDENCE ON THE IMPURITY VALENCE. 1. CALORIMETRIC DETECTION OF QUENCHED-IN DEFECTS IN METALLIC POWDERS. 2. GROWTH OF 2-4 COMPOUND AND ELECTROOPTICAL SINGLE CRYSTALS. 3 Final Technical Report, Jan. 1968—Feb. 1969
G. Poletti et al Sep. 1969 92 p refs
(Contract DAJA37-68-C-0259)
(AD-714678; ARDG/E/E-1105) Avail: NTIS CSCL 20/2

As a part of a wider experimental program on the behaviour of point defects in pure and impure noble metals equilibrium measurements of the influence of lattice vacancies and vacancy-impurity complexes on electrical resistivity of noble metals containing small percentages of noble-metal or transition-metal impurities have been performed. The binding energies of the impurity-vacancy complexes and the ratios of resistivity contributions of free to bound vacancies have been determined. The impurity-vacancy interaction results positive in six of the investigated solvent-solute systems, and null or negative in the other three. The results agree well with theoretical expectations and with other independent results in most cases. The few discrepancies are discussed. The possibility to detect quenched-in defects in platinum powder by microcalorimetric measurements is discussed, a powder quenching device is described and two projects for high sensitivity, high-temperature thermopiles, to be used in an isothermal microcalorimeter, are presented. Good-quality ZnTe and Zn(TeSe) single crystals and excellent-quality ADP, KDP, HIO3 and (NH4)2C2O4.H2O single crystals have been grown by various methods. The growth methods and the properties of obtained crystals are described and discussed. Author (GRA)

N71-16719# Wayne State Univ., Detroit, Mich.
NUCLEAR MAGNETIC RESONANCE STUDY OF THE CRYSTALLINE PHASES OF NbN(x) AND NbBe(x) AND SUPPLEMENT ON ACOUSTIC NUCLEAR MAGNETIC RESONANCE
Robert A. Bennett (Ph.D. Thesis) 1969 94 p refs
(Contract AT(11-1)-1700)
(COO-1700-11) Avail: NTIS

Nuclear magnetic resonance was employed to study the structure of several samples of the system NbNx where the mole fraction of nitrogen varied from 0.884 to 0.95. The samples of NbNx were in the form of powders. In the preparation of the various phases of NbNx, niobium or niobium hydride powder was heated in flowing nitrogen to the temperature (above 1200 C) at which the solid phases of NbNx are formed. The samples were rapidly cooled in a water-cooled chamber. In such a manner crystalline phases of NbNx which are formed and which were stable at high temperatures were quenched to room temperature where the crystalline phases are essentially stable. The powder samples used in the NMR investigations were examined at room temperature unless otherwise stated. The intermetallic compounds of the system, NbBex, were investigated because these materials are stable, have high strength, strength retention at elevated temperatures, and thermal-shock resistance. NSA

N71-16720# Utah Univ., Salt Lake City. Dept. of Physics.
PARAELECTRIC AND PARAELASTIC BEHAVIOR OF DIPOLE CENTERS IN CRYSTALS Final Report
Fritz Luty Oct. 1970 12 p refs
(Grant AF-AFOSR-1645-69)
(AD-714595; AFOSR-70-2418TR) Avail: NTIS CSCL 20/12

The original objectives of the grant, a thorough understanding of paraelectric defects in ionic crystals, their microscopic structure, their interaction with the lattice and their potential for applications, has been achieved for a large group of dipole/lattice systems. Some significant results of the electro-optical and electro-caloric work are mentioned. Besides this work directly along the line of the original objectives, investigations on related lattice defects with various experimental techniques (magneto-optical, Raman scattering polarized local mode absorption) are briefly reviewed. A list of 34 completed publications, 11 publications under preparation and the personnel which worked on the grant is given. Author (GRA)

N71-16823# Cornell Univ., Ithaca, N.Y. Dept. of Materials Science and Engineering.
PRESSURE AND TEMPERATURE DEPENDENCE OF THE ELASTIC CONSTANTS OF LiBr AND LiCl
L. S. Ching and Arthur L. Ruoff [1970] 29 p refs Sponsored by ARPA and AEC
(NYO-2504?8) Avail: NTIS

Measurements of the pressure and temperature dependence of the second order elastic constants from 220 to 340 K have been made on single crystals of LiBr and LiCl by the ultrasonic interferometric technique. The Debye temperatures theta sub 0 at 0 K for LiBr and 437 K for LiCl. Low and high temperature Gruneisen constants have also been calculated from the pressure derivatives at 89 K and 340 K. Author (NSA)

N71-16831# Illinois Univ., Urbana. Graduate College.
X RAY DEBYE TEMPERATURE OF SOLID KRYPTON
Richard Chase Windecker (Ph.D. Thesis) Oct. 1970 146 p refs
(Contract AT(11-1)-1198)
(COO-1198-762) Avail: NTIS

Measurements of integrated intensities of X-ray Bragg reflections have been made as a function of temperature on two large single crystal specimens of solid krypton. These data have been interpreted in terms of a Debye characteristic temperature, theta sub M. The specimens were prepared and maintained in a specially designed and constructed rigid-tail liquid helium cryostat and the measurements were made with a four-circle X-ray diffractometer designed for use with this cryostat. The values of theta sub M show a general qualitative agreement with existing quasi-harmonic and anharmonic theories. The high and low temperature expansion of theta sub M, in the harmonic approximation have been obtained showing that the high- and low-temperature limiting values of theta sub M, in this approximation are theta(−2) and theta(−3), respectively. The experimental value of theta(−2) obtained by this work is 87 + or − 5 K. Author (NSA)

N71-16832# Illinois Univ., Urbana. Dept. of Physics.
NUMERICAL STUDIES OF THE BETHE SALPETER EQUATION AND THE MULTIPERIPHERAL INTEGRAL EQUATION OF AMATI, BERTOCCHI, FUBINI, STANGHELLINI AND TONIN
H. W. Wyld, Jr. Jan. 1971 39 p refs
(Grant NSF GP-25303)
(ILL-(TH)-71-2) Avail: Issuing Activity

Numerical results for Regge poles determined from the Bethe Salpeter equation with scalar couplings are presented. Both the trajectories and residue functions are determined; it is a good approximation to ignore the coupling between different O(4) states. The effect of the second order correction to the potential (the crossed box graph) is studied and evaluated numerically. The relation of the Bethe Salpeter equation with the multiperipheral integral equation is reviewed and the latter equation is solved by numerical iteration. Some results are given which do not exhibit any oscillations in the total cross section. Author

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N71-16223* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METHOD AND APPARATUS OF SIMULATING ZERO GRAVITY CONDITIONS Patent
Helmut G. Lackner, inventor (to NASA) Issued 1 Sep. 1970 (Filed 11 Mar. 1969) 4 p Cl. 73-432; Int. Cl. G01l1/00
(NASA-Case-MFS-12750; US-Patent-3,526,140;
US-Patent-Appl-SN-806149) Avail: US Patent Office CSCL 21I

A method and apparatus for determining the effects of acoustic radiation pressure on a liquid suspended in a substantially frictionless environment. The apparatus includes an ultrasonic transducer excited by the output of a power amplifier. The power amplifier amplifies the output of an oscillator which has been adjusted to deliver an output at a frequency of approximately 100 kHz. The transducer is oriented so that the acoustic energy or pressure generated thereby is directed in a beam toward droplets of a cryogenic liquid floating on a precisely leveled plate. The droplet floats on a vapor envelope that surrounds and thermally insulates the droplet. Such a droplet can sustain for some time up to a minute. This apparatus and method makes it possible to investigate the transfer behavior of cryogenic liquids under zero gravity. Official Gazette of the U.S. Patent Office

N71-16348* Conrac Corp., Pasadena, Calif.
PENETRATING RADIATION SYSTEM FOR DETECTING THE AMOUNT OF LIQUID IN A TANK Patent
Rimvydas A. Kaminskas and Donald E. Wright, inventors (to NASA) Issued 17 Mar. 1970 (Filed 4 Jun. 1964) 13 p Cl. 250-43.5; Int. Cl. G01n21/26 Sponsored by NASA
(NASA-Case-MSC-12280; US-Patent-3,501,632;
US-Patent-Appl-SN-372648) Avail: US Patent Office CSCL 13D

Systems capable of measuring the amount of liquid in the interior of a tank or other container independently of the detailed figuration of the liquid or matter inside the container are described. A radiation source and detection system are arranged with respect to the area to be measured such that the effective absorption produced by the matter in the container is uniform throughout. R.B.

N71-16391*# Martin Marietta Corp., Denver, Colo.
INVESTIGATION OF SPACE STORABLE PROPELLANT ACQUISITION DEVICES. VOLUME 2: DESIGN AND ANALYSIS Final Report
Dec. 1970 173 p refs Prepared for JPL
(Contract NAS7-754)
(NASA-CR-116201; MCR-70-171-Vol-2) Avail: NTIS CSCL 21I

This investigation of space storable propellant acquisition devices was conducted to provide propulsion systems for post-1975 unmanned missions to Mars, Jupiter, and the outer planets. Two general mission requirements were considered: (1) flights to Mars that include midcourse, orbit insertion, and orbit trim maneuvers; and (2) a multiple planet fly-by, or grand tour mission, including a number of midcourse maneuvers. The problems associated with propellant orientation and control during a zero g were the primary concern. As a result, the investigation, selection, analysis, and design of the propellant acquisition devices received the major emphasis. The acquisition subsystem was the determining factor in selecting the preferred propulsion system (which also included pressurization and tankage subsystems) for each of the missions. Author

N71-16392* United Technology Center, Sunnyvale, Calif.
SOLID PROPELLANT LINER Patent
Marvin W. Stark, inventor (to NASA) Issued 21 Apr. 1970 (Filed 27 Nov. 1967) 5 p Cl. 60-39.47; Int. Cl. F02c3/26 Sponsored by NASA
(NASA-Case-XNP-09744; US-Patent-3,507,114;
US-Patent-Appl-SN-685750) Avail: US Patent Office CSCL 21H

A liner composition is described which is particularly useful with hybrid solid propellants containing lithium. The liner forms a chemical cross-linking with the fuel that results in exceptional bonding strength as well as compatibility. The liner is comprised of a matrix of hydroxy-terminated polybutadiene with toluene diisocyanate as the cross-linking agent. The amount of toluene diisocyanate utilized is determined by the hydroxy equivalent of the polybutadiene. A suitable catalyst, or a strengthening agent such as carbon black, may be added to the liner composition if desired. D.L.G.

N71-16687*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLID PROPELLANT ENGINEERING
In its Space Programs Sum. No. 37-65, Vol. 3, Aug. – Sept. 1970 31 Oct. 1970 p 163–167 refs (See N71-16671 06-30)
Copyright. Avail: NTIS CSCL 21I

A microwave burning rate measurement technique discussed utilizes recently developed microwave instrumentation to increase the resolution of earlier microwave techniques, making possible the measurement of propellant burning rates under conditions of rapidly changing pressure. The basic method was developed in 1965 for use in high-pressure burning rates studies. The method was first used for measuring transient burning rates following the introduction of high-resolution, fast-response microwave instrumentation. Author

N71-16689*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LIQUID PROPULSION
In its Space Programs Sum. No. 37-65, Vol. 3, Aug. – Sep. 1970 31 Oct. 1970 p 179–181 refs (See N71-16671 06-30)
Copyright. Avail: NTIS CSCL 21I

Liquid propulsion technology is considered for component storage with propellants and material compatibility. R.B.

N71-16864# Naval Air Propulsion Test Center, Philadelphia, Pa. Aeronautical Engine Dept.
CRASH FIRE HAZARD EVALUATION OF JET FUELS Final Report
Andrew J. Atkinson and Thor I. Eklund Jan. 1971 54 p refs
(Contract FA-66-NF-AP-14)
(FAA-NA-70-64; FAA-RD-70-72) Avail: NTIS

An investigation was conducted to determine the relative crash fire hazards of jet fuels under survivable crash conditions. Kerosene, JP-4, and mixtures of both were evaluated under various release modes (pools, drips, streams and sprays) and in the presence of possible ignition sources (electrical sparks, friction sparks, open flames, and hot surfaces). Wind speed, wind air temperature and fuel temperatures were also varied. The results of the evaluation and the conclusions reached are discussed. Author

N71-16885*# Colspan, Inc., Boulder, Colo.
EXTERNAL INSULATION SYSTEMS FOR CRYOGENIC STORAGE SYSTEMS: BIBLIOGRAPHY/SYNOPSIS AND

CATEGORY REPORT (TYPE 2 DATA)
Thomas M. Flynn and Jerry B. Kirgis 2 Jul. 1970 283 p refs
(Contract NAS9-10583)
(NASA-CR-114826) Avail: NTIS CSCL 21I

The results are described of the first phase of a program to investigate high performance external insulation systems for use on flight weight cryogenic gas storage systems. External insulation refers to anything added to a cryogenic storage system for the purpose of thermally protecting it from its environment. This definition excludes the vacuum annulus of a dewar. The fluids stored are hydrogen and oxygen. The results reported include the following tasks: (1) a literature search on all of the available material concerning external insulation studies and/or evaluation; (2) a complete bibliography of the material researched; (3) a synopsis for each of the most useful references contained in the bibliography; and (4) a categorization of the results of the work to facilitate evaluation and assessment. Author

N71-16866*# Bell Aerospace Co., Buffalo, N.Y.
APOLLO RCS POSITIVE EXPULSION TANKAGE PRODUCT IMPROVEMENT PROGRAM: ELIMINATION OF PERMEATION AND BUBBLE FORMATION, TASK D Final Report, Jul. 1967 – Sep. 1969
26 Nov. 1969 93 p
(Contract NAS9-7182)
(NASA-CR-114812; Rept-8514-928003) Avail: NTIS CSCL 21I

The results are presented of a study to eliminate or reduce the problem of bubble formation on the propellant side of Apollo RCS positive expulsion propellant tanks. Two approaches taken in performing this task include: (1) the development of a permeation barrier in the form of an added bladder laminate; and (2) by means of analytical and experimental investigation, identify and understand the mechanisms involved in bubble formation in current bladder configurations and devise methods to eliminate or control them. Author

N71-16867*# Bell Aerospace Co., Buffalo, N.Y.
APOLLO RCS POSITIVE EXPULSION TANKAGE PRODUCT IMPROVEMENT PROGRAM, TASK F: INTEGRATION AND VERIFICATION OF SOLUTIONS Final Report, Jul. 1967 – Sep. 1969
19 Jan. 1970 40 p
(Contract NAS9-7182)
(NASA-CR-114814; Rept-8514-928007) Avail: NTIS CSCL 21I

Service module oxidizer (SMO) bladders of the same undersized configuration as the lunar module bladder and containing an aluminum foil laminate were to be subjected to vibration, 30-day propellant exposure, and propellant expulsion testing. Three bladders of this design were subjected to vibration testing and failed during this phase of the test program. Consequently, the propellant exposure and expulsion tests were not performed. It was concluded that the failure of these bladders does not invalidate the design concept, but rather points out that the bladder film thickness was too great to perform well with the present method of attachment to the diffuser tube. Author

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N71-16824# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany). Inst. fuer Chemische Raketenantriebe.
ON THE DISCHARGE COEFFICIENT OF CHEMICAL ROCKET-ENGINE-INJECTORS [UEBER DEN AUSFLUSSBEIWERT VON EINSPRITZSYSTEMEN CHEMISCHER RAKETENTRIEBWERKE]
Josef Reinkenhof Sep. 1970 35 p refs
(DLR-FB-70-38) Avail: NTIS; ZLDI Munich: 9.70 DM

A theoretical flow model for the sharp-edged orifices of an injector, which permits calculation of the discharge coefficient as a function of Reynolds number and a geometric parameter, is presented. Differences between the model and practical injector systems are discussed. The discharge coefficient of a high-energy rocket engine injector system was experimentally investigated and compared with the model predictions. Author (ESRO)

N71-16835*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LANGMUIR PROBE MEASUREMENTS IN A SERT 2 THRUSTER DISCHARGE CHAMBER
George A. Csiky Washington Jan. 1971 24 p refs
(NASA-TM-X-2088; E-5776) Avail: NTIS CSCL 21C

A hollow cathode Kaufman thruster of the type used in the SERT 2 mission was operated in a vacuum bell jar without application of high voltage to extract a beam. Electron density, electron temperature, and plasma potential values were deduced from Langmuir probe measurements at various points in the ion chamber and in the cathode pole piece region. The purpose was to find out what changes occur in the plasma parameters as ion chamber geometry and operating conditions were varied from the SERT 2 values. Changes were made with respect to baffle position, flow conditions, and magnetic field, and the resulting plasma parameter profiles were compared. Only slight changes in the electron density, electron temperature, and plasma potential levels were found for considerable variation of conditions. However, the shape of the profiles of these parameters changed noticeably. The gradients in these parameters may play a significant role in thruster performance. Author

N71-15836*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REVIEW OF SERT 2 POWER CONDITIONING
James W. Bagwell, Anthony C. Hoffman, Robert J. Leser, Karl F. Reader, John B. Stover et al Washington Jan. 1971 30 p refs
(NASA-TM-X-2085; E-5801) Avail: NTIS CSCL 21C

The SERT 2 power conditioner was required to meet severe operating conditions. These conditions include operation in vacuum, potential differences of 4000 volts, and frequent and unavoidable thruster arcs. Techniques provide satisfactory, reliable performance for a period of at least six months are discussed. The techniques include open-to-vacuum construction of magnetic components, automatic overload protection, conformal coating, and aluminum-coated insulating sheets as barriers. The performance of the power conditioning system is discussed. Author

N71-15894*# Ion Physics Corp., Burlington, Mass.
ELECTRON ACCELERATOR FOR AEROBEE 350 ROCKET: DESCRIPTION, DEVELOPMENT AND FLIGHT PERFORMANCE Final Report
William C. Beggs 30 Nov. 1970 212 p refs
(Contract NAS5-9326)
(NASA-CR-116087) Avail: NTIS CSCL 19G

The development and test of two electron accelerator systems for Aerobee 350 rocket, and the flight and flight performance of one of the systems are described. The system was successfully used to inject a beam of electrons from an Aerobee 350 sounding rocket for the purpose of establishing whether a beam could be ejected from a vehicle into the upper atmosphere, could pass through the existing and beam generated background plasma without strongly and deleteriously interacting with it, and could produce adequate excitation and ionization for ground viewing by optical and radar viewing equipment. The system is described and operational specifications and calibrations for both units are given. The key issues, problem areas and solutions of the design and development program are summarized. The launch operation, the payload performance, and a partial analysis of the results, particularly concerning the results of the collector current measurements, are also discussed. The T/M reception on the flight was excellent and the payload performance without fault. Author

N71-15915*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CONTAMINATION OF SPACECRAFT SURFACES DOWNSTREAM OF A KAUFMAN THRUSTER

Thaine W. Reynolds and Edward A. Richley Washington Jan. 1971 29 p refs

(NASA-TN-D-7038; E-5913) Avail: NTIS CSCL 21H

Results of experiments to evaluate the effects of thruster exhaust products on surfaces located downstream of two mercury electron-bombardment ion thrusters are presented. It is shown that severe contamination can result from accelerator grid sputtering. The flux of grid sputtered material, though smaller in magnitude than the neutral mercury flow, will readily condense on and not reevaporate from surfaces at temperatures normally expected in near-Earth orbits. Measurements of solar-cell output were used to monitor the deposition rate of material onto the cell surfaces. Metallic deposits, identifiable with grid components by spectrographic analysis, accumulated at rates consistent with calculated deposition rates of sputtered grid material. Author

N71-15916*# Ion Physics Corp., Burlington, Mass.

CONSIDERATIONS OF ELECTRON BEAM PROPAGATION FROM SPACE VEHICLES

W. C. Beggs, R. Cheever, and W. McNeal Oct. 1970 23 p refs

(Contract NAS5-3935)

(NASA-CR-116088) Avail: NTIS CSCL 21C

Theoretical considerations given to the problem of propagating an electron beam array from a space vehicle are presented. The first few sections consider the velocity associated with the beam front, the maximum beam current which is compatible with vehicle neutralization via plasma return currents, and the beam spreading caused by space charge blow-up (with the earth's magnetic field being treated in first approximation). Finally, considerations are made of the possibility of further beam blow-up caused by a two-stream instability. Conclusions and recommendations for further studies are made. Author

N71-16035*# Analytical Mechanics Associates, Inc., Seabrook, Md.

SOLAR ELECTRIC PROPULSION MISSION REQUIREMENTS STUDY Final Report

J. L. Horsewood and F. I. Mann Dec. 1970 35 p refs

(Contract NAS5-20126)

(NASA-CR-116147; Rept-70-48) Avail: NTIS CSCL 21C

The results are summarized of a program to generate optimum low thrust trajectory and performance data which are necessary to define the applicability of solar-electric propulsion as a means of primary propulsion for the unmanned exploration of the solar system. Author

N71-16047*# Rocketdyne, Canoga Park, Calif.

PERFORMANCE ANALYSIS OF PROPULSION SYSTEMS Final Report, 17 Jun. 1969 – 18 Oct. 1970

J. A. Wrubel Nov. 1970 314 p refs

(Contract NAS8-24568)

(NASA-CR-103024; R-8390) Avail: NTIS CSCL 21H

The improved understanding of gas-stream turbulent mixing is contingent upon obtaining a more comprehensive description of the resultant flow field and a more precise evaluation of the turbulent transport properties. A facility for study of this phenomenon was constructed and checked out. Characterization and diagnostic experiments together with some data analysis were accomplished and are described. The flow field experimentally studied was the two-dimensional mixing of fuel-rich supersonic hydrogen-oxygen combustion products and a subsonic heated air-stream. The mixing was accomplished in a chamber accessible to both optical and probe type instrumentation systems. A total of 36 tests were conducted which included studies of: (1) film coolant interaction, (2) the two-dimensionality of the flow, (3) air temperature effects, (4) velocity ratio effects, (5) airstream turbulence effects, and (6) configuration effects. The data gathered consisted of: (1) test section static pressure, (2) mixing layer temperature, (3) partial pressure of H2O, (4) photographic information (UV, IR, color, and Schlieren), and (5) facility operation. Author

N71-16048*# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.

FLUID MECHANICS APPROACH TO ACOUSTIC LINER DESIGN

T. S. Tonon, W. A. Sirignano and D. T. Harrje Dec. 1970 133 p refs

(Grant NGL-31-001-155)

(NASA-CR-72807; AMS-963) Avail: NTIS CSCL 21H

A working guide is presented in the construction of acoustic liners for the suppression of combustion instability in liquid propellant rocket motors with chamber geometries most often occurring in practice. The geometry of the liners may consist of Helmholtz resonators, quarter-wave (or some multiple) tubes, or half-wave (or some multiple) tubes. Certain optional design procedures are developed; optional in the sense that the space occupied by the liner is minimized, subject to various constraints. A method for the evaluation of the stabilizing effectiveness of a given design is also presented. Among the effects considered in these procedures are the high amplitude chamber pressure oscillations, both mean and oscillatory chamber flows, a liner-mean-through flow, differences between the mean temperatures, molecular weights, ratio of specific heats between the liner backing volume, and the local environment in the combustion chamber. Author

N71-16224* Brown Engineering Co., Inc., Huntsville, Ala.

COLLAPSIBLE NOZZLE EXTENSION FOR ROCKET ENGINES Patent

Warren E. Darrow, Jr. and Billy C. Ursery, inventor (to NASA) Issued 1 Sep. 1970 (Filed 21 May 1968) 8 p Cl. 239-265.43; Int. Cl. B64c15/06 Sponsored by NASA

(NASA-Case-MFS-11497; US-Patent-3,526,365; US-Patent-Appl-SN-730733) Avail: US Patent Office CSCL 21H

A collapsible nozzle extension for a rocket engine comprising a set of conical extension sections that are telescoped in the collapsed positon and mate end to end in the extended position. The conical sections and existing engine nozzle are interconnected by a plurality of folding and extending linkage arms, each comprising a series of pivotally connected links, circumferentially spaced around the nozzle. The links incorporate springs that urge the folded linkage arms and thus the conical extension sections toward the extended position, and the arms are latched in the folded position by a mechanism that releases the arms for nozzle extension. Official Gazette of the U.S. Patent Office

N71-16225# Army Foreign Science and Technology Center, Washington, D.C.

MATHEMATICAL MODELLING OF GAS TURBINE SUPERCHARGING IN MULTICYLINDER FOUR-CYCLE ENGINES [MATEMATICHESKOE MODELIROVANIE RABOTY SISTEM GAZOTURBINNOGO NADDUVA MNOGOTSILINDROVYKH CHETYREKHTAKTNYKH DVIGATELEI]

L. A. Samsonov 9 Feb. 1970 16 p refs Transl. into ENGLISH from Energomashinostroenie (Moscow), v. 13, no. 9, 1967 p 19–22
(AD-713873; FSTC-HT-23-358-70) Avail: NTIS CSCL 21/7

The principle features are presented of a method of mathematical modelling of the operation of a supercharging system for multicylinder four-cycle engines developed; a comparison is presented of the results of modelling of the operation of the supercharger for engine 4CHN15.5/20.5 using the Ural-2 computer with experimental data. Examples are presented of the investigation of the influence of design of the system on its parameters. GRA

N71-16305# Army Foreign Science and Technology Center, Washington, D.C.

ENGINE LIFE

I. A. Mishin 7 May 1970 310 p refs Transl. into ENGLISH of the book 'Dolgovechnost Dvigateley' Leningrad, Mashinostr. Press, 1968 p 1–260
(AD-714063; FSTC-HT-23-135-69) Avail: NTIS CSCL 21/7

Information on the nature of phenomena which take place in the surface layers of the metal of engine components during friction is briefly generalized in the book, the fact of physical and mechanical properties of the surface of metal and the geometrical parameters of surface quality on the durability of the components is considered, basic requirements set forth for quality of surface friction of components and measures which increase the reliability and life of engine couplings are presented, methods of estimating the period of trouble-free operation of components and fine of assemblies are indicated. Author (GRA)

N71-16592*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

CONCEPTS FOR COST REDUCTION ON TURBINE ENGINES FOR GENERAL AVIATION

Robert L. Cummings and Harold Gold Feb. 1971 22 p Proposed for presentation at Western Metal and Tool Exposition Conf., Los Angeles, 8–11 Mar. 1971
(NASA-TM-X-52951) Avail: NTIS CSCL 21E

Current results of a study of methods for achieving drastic cost reduction on gas turbine engines for general aviation aircraft are presented. Performance trade-offs for engine simplicity are discussed. Results of fabrication studies on simplified axial stage constructions are presented. Author

N71-16593*# Bell Aerospace Co., Buffalo, N.Y.

LOW FREQUENCY PRESSURE OSCILLATION STUDY, PHASE 1 Interim Study

T. Shew and A. Lytle Jul. 1970 150 p
(Contract NAS9-10381)
(NASA-CR-114800) Avail: NTIS CSCL 21H

Low frequency pressure oscillations (LFO), have been observed during the Apollo program on both the SPS and APS engines. These oscillations normally display a periodic frequency. The amplitude tends to increase and decrease in such a manner that the envelope of the pressure/time instrumentation recordings tend to describe a shape similar to footballs. The general characteristics of these oscillations are amplitudes of 10 to 50 psi, periodic frequencies ranging from 300 to 500 Hz, and durations from 0.1 to 2.0 seconds. If the oscillations occur, they generally occur immediately after the start transient overshoot. The occurrence of the oscillations appears to be very sensitive to the amount of helium contained in the fuel. Under extreme operating conditions of helium saturation and chamber pressure, the start football did not dampen, resulting in sustained oscillations. Author

N71-16640*# Westinghouse Electric Corp., Lima, Ohio. Aerospace Electrical Div.

OPEN CONSTRUCTION MAGNETIC COMPONENTS FOR THE SERT 2 POWER CONDITIONER

D. S. Yorksie and J. Legadinos (Raytheon Co., Waltham, Mass.) *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 77–89 Prepared in cooperation with Raytheon Co., Waltham, Mass. (See N71-16631 06-09)
Avail: NTIS CSCL 21C

The configuration evaluation, design criteria formulation, and materials selection for the power transformers and inductors are discussed. Details are given on the electrical and mechanical stress limits, and the mechanical configuration of the magnetic components. Materials for layer insulation, magnet wire insulation, and bobbin material were selected by vacuum tests, thermal stability, outgassing characteristics, and mechanical and electrical properties. Magnetic materials for the core were considered from the standpoint of efficiency, size, and weight. N.E.N.

N71-16701# Rocketdyne, Canoga Park, Calif.

EXPERIMENTAL EVALUATION OF A THRUST VECTOR LOAD CELL Final Report, Nov. 1969–Feb. 1970

R. W. Postma Nov. 1970 29 p refs
(Contract F40600-70-C-0007)
(AD-714060; R-6254; AEDC-TR-70-248) Avail: NTIS CSCL 14/2

This report describes the results of an experimental evaluation of a half-scale (physical size) model of a previously analyzed six-component force balance for testing rocket engines. The force range of the model was scaled down from 5000 foot pounds to 200 foot pounds, and structural parameters were scaled to represent those of the full-scale version which was analyzed under Contract F40600-68-C-0004. The evaluation includes the determination of (1) first- and second-order interactions of single and combination loads and (2) the effect of combination loads at expected gimbal points for typical rocket engines. The data which are presented in tabulated form, validate the prior analysis, and demonstrate that short force measuring links, assembled into a compact integral structure, do not result in excessive interactions. Author (GRA)

N71-16716*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Propulsion Div.

EXPERIMENTAL OBSERVATIONS RELATING THE INCEPTION OF LIQUID ROCKET ENGINE POPPING AND RESONANT COMBUSTION TO THE STAGNATION DYNAMICS OF INJECTION IMPINGEMENT

Richard M. Clayton 15 Dec. 1970 52 p refs
(Contract NAS7-100)
(NASA-CR-116245; JPL-TR-32-1479) Avail: NTIS CSCL 21H

Ordinary liquid rocket combustion processes are never truly steady processes. They are usually observed as low intensity, random combustion-chamber pressure variations. However, a clearly distinguishable, aperiodic form of nonsteadiness is also frequently observed. This form of nonsteadiness is characterized by discrete, large amplitude waves propagated throughout the combustion volume and is classified as popping. Popping and resonant combustion, as exhibited by annular and cylindrical versions of an 18-in.-diam engine, are found to occur for a particular range of propellant temperature and mixture ratio conditions used in a

boundary (near wall) injection system. The correlation of these conditions of temperature and mixture ratio is based on the argument that the impingement of two streams of equal dynamic pressure is inherently unsteady, and that small variations to either side of unity dynamic-pressure ratio can produce relatively large changes in the mixture and direction of the efflux from the impingement region. Pops are extremely effective in precipitating sustained combustion resonance unless the combustor is stabilized by control devices such as baffles. Reactive streams (hypergolic systems) and nonreactive streams (like-on-like systems) are discussed, as well as a proposed mechanism for producing initial combustion disturbances. Author

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N71-15843# Academy of Sciences (USSR), Moscow.
COSMIC DATA: MONTHLY REVIEW NO. 7, JULY 1969
1970 36 p In RUSSIAN; ENGLISH summary
Avail: NTIS

The results are presented of observations on geophysical phenomena concerning the electric and magnetic state of the upper atmosphere (geomagnetic variations, ionosphere; cosmic rays and earth currents) and solar activity data. Author

N71-15844# Academy of Sciences (USSR), Moscow.
COSMIC DATA: MONTHLY REVIEW NO. 8, AUGUST 1969
1970 35 p ref In RUSSIAN; ENGLISH summary
Avail: NTIS

Results are presented of observations on geophysical phenomena concerning the electric and magnetic state of the upper atmosphere (geomagnetic variations, ionosphere, cosmic rays) and solar activity data. Author

N71-15886*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR CYCLE VARIATION OF PLANETARY EXOSPHERIC TEMPERATURES
S. J. Bauer Jan. 1971 6 p refs Submitted for publication
(NASA-TM-X-65419; X-620-71-8) Avail: NTIS CSCL 03A

The use is described of a simple scaling law, based on an approximate solution of the heat balance equation, to determine the variation of exospheric temperature over a solar cycle. Exospheric temperature is defined as the temperature of the isothermal region (on account of heat conduction) extending into the exosphere and thus controlling the escape of gases from planetary atmospheres. The integration and scaling procedures used in determining the exospheric temperature are given. Author

N71-16347# Physikalisch-Meteorologisches Observatorium, Davos (Switzerland).
SOLAR INTENSITY AND INTENSITY AND POLARIZATION OF SKY RADIATION FOR 347.0, 488.0 AND 533.5 nm AT SELECTED POINTS ALONG THE SUN'S VERTICAL AND OTHER MERIDIANS MEASURED AT 2818 METERS ABOVE SEA LEVEL
Paul Bender Aug. 1970 140 p refs
(Contract DAJA37-68-C-1017)
(AD-714676; E-1364) Avail: NTIS CSCL 4/1

Measurements of solar intensity and of the brightness and polarization of sky radiation for 347.0, 488.0 and 533.5 nm have been made at Weissfluhgipfel (2818 m a.s.l., near Davos, Switzerland) for angular elevations of 90 degrees, 60 degrees, 30 degrees, and 15 degrees along the suns vertical and along the meridians at 45 degrees and 90 degrees azimuth angle to the suns vertical. The essential parts of the spectrophotometer applied for this investigation are described. The method of measurement and evaluation is discussed. The results are presented in two main tables giving the values of intensity and polarization as well as the time and the values of solar altitude and airmass for each measurement taken. The results on solar intensity are examined in dependence on airmass and the apparent values of extra-terrestrial intensity and of optical thickness are determined for each measuring series. Author (GRA)

N71-16522# Joint Publications Research Service, Washington, D.C.
RADIATION HAZARDS IN SPACE FLIGHT
In its Probl. of Space Flight 2 Feb. 1971 p 19-24 (See N71-16520 06-04)
Avail: NTIS

The effects of combined radiations from galactic sources, solar flares, and the earth's radiation belts on man during interplanetary flights were evaluated. Results from three year long ionizing radiation experiments on dogs, simulating galactic irradiation, show that the 100 rem which a cosmonaut may receive during a year long flight will not damage his health if proper safety measures are taken. Experimental simulation of solar flare proton irradiation of dogs at energies from 50 to 600 MeV revealed that the danger is exaggerated. G.G.

N71-16525# Illinois Univ., Urbana. Ionosphere Radio Lab.
INVESTIGATIONS OF IONOSPHERIC TOTAL ELECTRON CONTENT BEHAVIOR AT CONJUGATE POINTS AND DURING A SOLAR ECLIPSE Final Report, 1 Sep. 1969 - 31 Aug. 1970
Kung C. Yeh, Bernard J. Flaherty, Han R. Cho, and Homayoun Nomani Sep. 1970 88 p refs
(Contract F19628-70-C-0001)
(AD-714571; AFCRL-70-0539; TR-41) Avail: NTIS CSCL 4/1

The Faraday rotation data were collected at Cold Bay, Alaska in an effort to correlate with similar data collected at Invercargill, New Zealand. Cold Bay and Invercargill form an approximate conjugate pair. Day-to-day variations of content at these two stations have been compared and studied. It has been found that these changes were negatively correlated during periods of magnetic quiet, uncorrelated during weak magnetic activities and increasingly positively correlated with increasing magnetic activities. In the second experiment two field stations were set up along the path of March 7, 1970 solar eclipse. These data, when combined with data obtained by others, show that the delay between the time of maximum obscuration and the time of minimum content varies systematically with latitude. The theoretical study is concerned with studying the effect of a dynamo electric field on the thermospheric winds. Author (GRA)

N71-16602*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPOSITION AND SPECTRA OF HIGH ENERGY COSMIC RAYS. A PROPOSAL FOR AN ORBITING LABORATORY FOR THE HEAO
J. F. Ormes, V. K. Balasubrahmanyan, T. Bowen (Ariz. Univ.), R. W. Huggett (La. State Univ.), T. A. Parnell et al Jan. 1971 232 p refs Submitted for publication
(NASA-TM-X-65431; X-661-71-1) Avail: NTIS CSCL 03B

The presently detectable galactic cosmic radiation extends in energy from about 10 to the 7th power to 10 to the 20th power eV and in charge from Z = 1 to about 100. The energy region from 10 to the 10th power to 10 to the 14th power eV is a large but little studied segment of the cosmic ray spectrum. An experiment to investigate charged cosmic ray primaries in this energy range is proposed for the HEAO satellites. The experiment consists of three major sections: (1) charge identification, (2) trajectory definition, and (3) energy measurement. The charge identification system used two organic scintillators, a plastic Cerenkov radiator, an inorganic CsI scintillator, and a pulse ion chamber system. An instrument based upon our present balloon flight programs was designed to determine the intensities of protons, electrons, alpha particles, and heavier nuclei as a function of energy. Engineering design, data analysis plans, management aspects, possible second generation developments, and a description of the relevant scientific background are presented. Author

N71-16603*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TIME DEPENDENT PLASMAPAUSE MOTION
J. M. Grebowsky Jan. 1971 23 p refs Submitted for publication
(NASA-TM-X-65433; X-621-71-11) Avail: NTIS CSCL 03B

Assuming that the earth's magnetic field is dipolar and that the dayside magnetic field lines are electrically shorted to one another due to the high ionospheric conductivity, an analytic electric field model is developed which describes the flow of thermal plasma from the magnetosphere tail. Using this field model, the steady state plasmapause has a bulge centered at 2100 LT. During periods of sudden magnetic quieting, the bulge tends to corotate with the earth. After a sudden onset of magnetic substorm activity, the model predicts that plasma will be peeled from within the original plasmasphere and will be transported out of the magnetosphere in the dusk-midnight sector. In agreement with previous studies, these temporal variations will cause considerable fine structure in the region of the bulge. However, this model is not valid during periods of intense magnetic activity since whistler measurements detect the bulge on dayside field lines under such conditions. Author

N71-16604*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OBSERVATIONS OF THE INTERPLANETARY MEDIUM: VELA 3-IMP 3, 1965–1967
N. F. Ness, A. J. Hundhausen (Los Alamos Sci. Lab.), and S. J. Bame (Los Alamos Sci. Lab.) Nov. 1970 53 p refs Submitted for publication Sponsored in part by ARPA and AEC
(NASA-TM-X-65436; X-690-71-23) Avail: NTIS CSCL 03B

Simultaneous observations of the interplanetary plasma by the Vela 3 satellites and the interplanetary magnetic field by the IMP 3 satellite from July 1965 to July 1967 are presented. Pertinent derived plasma properties are computed and statistically tabulated. A detailed correlation of relevant plasma parameters suggest that the interplanetary medium is not a magnetized plasma in which equi-partition of energy exists between the plasma and magnetic field. Rather the thermal energy density of the plasma, considering both ions and electrons, appears to be a factor of 3 or more greater than the magnetic field energy density. The average Alfven speed is drived to be 36 km/sec which yields a Mach flow of 10.7. The solar wind plasma most frequently is stable with respect to the firehose mode of instability. The existence of an evolutionary sector geometry does not destroy the pattern of correlated variation of plasma and field parameters observed within the sectors although the distortion of sectors by propagating shock waves is suggested. Author

N71-16666*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACE SIMULATION
In its Space Programs Sum. No. 37-65, Vol. 3, Aug. – Sep. 1970 31 Oct. 1970 p 158–162 refs (See N71-16671 06-30)
Copyright. Avail: NTIS CSCL 03B

During X-15 flight 3-64-95 successful solar irradiance data were obtained at an elevation of 75 to 80 km above sea level. Within the pass-band of the instrument this elevation represents essentially the extraterrestrial solar flux. The design details of the multichannel radiometer are presented and calibration techniques are given. Integration of the radiometer into the pod of the X-15, solar orientation, computation, and signal conditioning are discussed. The solar irradiance of the total and broad-bands are presented and the X-15 results are compared with the B-57 and CV990 data extrapolated from 12 km. The results of the narrow-band channels are reported and these values are compared with the energy in the equivalent bands of four currently popular solar spectral irradiance curves. Author

N71-16706*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPOUND DIFFUSION OF COSMIC RAYS
R. E. Lingenfelter (California Univ., Los Angeles), R. Ramaty, and L. A. Fisk Jan. 1971 22 p refs Submitted for publication
(Grant NSF GA-19605)
(NASA-TM-X-65437; X-660-71-26) Avail: NTIS CSCL 04A

The combined effects of the one-dimensional diffusion of cosmic rays along interstellar magnetic field lines and the three-dimensional random walk of these field lines due to interstellar turbulence are considered. The resulting compound diffusion can account for the observed low anisotropy of cosmic rays in terms of a correlation length of a few tens of parsecs which is consistent with the observational data on the scale of the interstellar turbulence. Author

N71-16731 Case Western Reserve Univ., Cleveland, Ohio.
MEASUREMENT OF THE COSMIC RAY GAMMA-RAY ENERGY SPECTRUM AT BALLOON ALTITUDES
Jon Albert Staib (Ph.D. Thesis) 1969 82 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 70-4988

A method is presented for measuring a gamma-ray energy spectrum by observing the scattering of electron-positron pairs in a thin-plate, multi-gap chamber. The quantity of scattering measurement was the second difference of the lateral displacements. Calculations are presented which show the dependence of the average second difference on the electron energy, the inclination angle, and the cell length. The cell length is the number of gaps between successive measurements of the lateral displacements. Scattering measurements on known energy electrons showed good agreement with this relation for inclination angles below 25 degrees. A calculation is described for obtaining the measured electron energy spectrum from an incident gamma-ray spectrum. This calculation makes corrections for those pairs not resolved by the spark chamber. Dissert. Abstr.

N71-16732 Case Western Reserve Univ., Cleveland, Ohio.
DETERMINATION OF STELLAR MAGNITUDES FROM OBJECTIVE PRISM SPECTRA
Charles Don Geilker (Ph. D. Thesis) 1968 99 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 70-5018

A modification of the Eichner astrophotometer is described, in which the use of a fixed rectangular slit in place of the circular variable iris diaphragm permits the astrophotometer to be used to

determine stellar magnitudes from objective prism spectra. By choosing slits of suitable dimensions, both intermediate and low dispersion spectra may be measured to yield magnitudes approximating the international photographic or UBV system. Monochromatic magnitudes may also be determined, and the procedures hold promise for equivalent widths and photographic photometry. Substitution of a circular opening for the slit affords use of the instrument in the classic fixed aperture, or Schilt photometer, form. Dissert. Abstr.

N71-16748# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
DIFFERENTIAL ENERGY SPECTRUM OF GEOMAGNETICALLY TRAPPED PROTONS WITH THE INJUN 5 SATELLITE Progress Report, 1 Aug. 1968–9 Feb. 1969
G. Pizzella and B. A. Randall Jul. 1970 32 p refs
(Contract N00014-68-A-0196-0003)
(AD-714513; Rept-70-37) Avail: NTIS CSCL 4/1

The proton energy spectrum in the radiation belt has been obtained with the Injun 5 satellite for the period August 1968 through 9 February 1969 in the energy range 0.3 to 74 MeV. The most salient features of the differential energy spectrum are: in the inner belt there is a minimum at about 2 MeV; and in the outer belt the E sub o parameter is proportional to L to the power((-1.67) plus or minus 0.07). The last feature cannot be explained with the diffusion theory, at least at its present stage of development. Author (GRA)

N71-16749*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TOPICS IN SOLAR COSMIC RAY AND X-RAY PRODUCTION
Thomas L. Cline Dec. 1970 50 p refs Presented at Intern. Seminar on Solar Cosmic Ray Generation, Leningrad, 8–12 Dec. 1970
(NASA-TM-X-65439; X-661-71-33) Avail: NTIS CSCL 03B

Topics related to energetic interplanetary particle and X-ray production by the sun are presented. They are based upon certain observations of solar protons, electrons, and X-rays resulting from some experiments using the IMP, OGO, and OSO series of satellites. These observations help to provide a basic phenomenology needed for the theorizing of an accurate and complete picture of particle acceleration at the sun. The present results contrast to the solar particle data available a decade ago in that these were gathered using instruments with lower energy sensitivity, which were flown outside the earth's atmosphere and magnetosphere, and were exposed throughout much of the solar cycle. These data show that solar energetic particles are produced more often than only in the larger flares and suggest that they are produced in more than one manner. Author

N71-16750*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CALIBRATION OF THE NASA-GSFC HIGH ENERGY COSMIC RAY EXPERIMENT
H. Whiteside (Federal City Coll), C. J. Crannell (Catholic Univ. of Am.), J. F. Ormes, and M. J. Ryan Jan. 1971 38 p refs
(NASA-TM-X-65440; X-661-71-36) Avail: NTIS CSCL 03B

The experimental conditions under which the NASA-GSFC High Energy Cosmic Ray Experiment was calibrated with the G-10 + 4.7 deg test beam are described. A detailed discussion is given of the momentum of the test beam used. In addition, summaries of the data runs taken are included. Author

N71-16751 Auburn Univ., Ala.
INTERACTIONS DUE TO HIGH Z PARTICLES IN THE PRIMARY COSMIC RAYS
Philip John Young (Ph.D. Thesis) 1969 65 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 70-1934

A study was made of the nature of 17 interactions in nuclear emulsions of high Z charged particles in the primary cosmic ray flux. The charges of the primary particles were determined by means of their delta-ray densities. The masses and energies of the secondary particles were determined by means of their grain densities and multiple Coulomb scattering. Among the secondary particles, 8 protons, 18 pions, 2 kaons, 3 deuterons, and 6 alphas were identified. An estimate of the average number of nucleon collision pairs per event was made. Dissert. Abstr.

N71-16821 Case Western Reserve Univ., Cleveland, Ohio.
DYNAMICAL STRUCTURES IN H II REGIONS
David Llewellyn Roberts (Ph.D. Thesis) 1968 67 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 70-5047

Numerical methods are used to obtain solutions of the equations describing gas motions and radiative transfer in an H II region. The evolution during which dynamical processes become dominant over radiative processes in determining ionization front structure are discussed. The gas is heated by the stellar radiation field and cooled by recombinations and radiation in the forbidden lines of oxygen. Two sequences of models are reported: (1) The evolution of an ionization front moving into a constant-density neutral medium and the encounter of an (initially R-type) ionization front with a region in which the density of neutral matter increases linearly with distance from the exciting star. The principal conclusion of this investigation is that cooling processes in the neutral gas dominate the post-shock structure, once the shock and ionization fronts have separated. Dissert. Abstr.

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N71-16823# Royal Aircraft Establishment, Farnborough (England).
THE DETERMINATION AND USE OF THE ORBIT OF PROTON 4
H. Hiller Aug. 1970 14 p refs
(RAE-TR-70136) Copyright. Avail: NTIS

More than 900 optical and radar observations, from 67 observing stations, were used to determine orbits of Proton 4 (1968-103A) at 20 epochs. The standard deviation in inclination was 0.3 secs of arc, and in eccentricity was equivalent to 20 meters in perigee distance. The inclination values were used to calculate the atmospheric rotational speed at 240 km mean height. Author (ESRO)

N71-16863 Michigan Univ., Ann Arbor.
FLUX DENSITIES OF PLANETARY NEBULAE AT 8.0 GHz AND 16.2 GHz
Jerry Ray Ehman (Ph.D. Thesis) 1969 90 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-17993

The planetary nebulae NGC 3242 and NGC 6781, previously known to be confused by non-thermal sources nearby, have values of flux density consistent with thermal spectra for these nebulae.

No convincing evidence exists that any of the nebulae measured here have non-thermal spectra. IC 418, NGC 6572 and NGC 7027 have spectra indicating that either the electron temperature or the density, or both, are not constant throughout these nebulae. Several nebulae appear to have an optical depth greater than or comparable to unity at 8.0 GHz, implying large electron densities and thus small radii. Values of optical depth at 8.0 GHz, emission measure and electron density are calculated from the measured flux densities at 8.0 GHz for 46 nebulae. These electron densities are roughly a factor of 4 times smaller than corresponding values calculated from H beta emission. Different emitting regions for the radio and H beta emission is the most likely explanation. Dissert. Abstr.

N71-15898*# Sandia Corp., Albuquerque, N.Mex. Planetary Quarantine.

A PRELIMINARY ANALYSIS OF THE RADIATION BURDEN OF A TYPICAL MARS LANDER MISSION

Virgil L. Dugan Dec. 1970 32 p refs

(NASA-Order W-12853)

(NASA-CR-116144; SC-RR-70-769) Avail: NTIS CSCL 22A

An analysis is provided of the total radiation which a typical Mars lander would experience. The dose from each source of radiation is calculated for spacecraft shielding of 1 and 10 gm/sq cm, assuming a one year flight time and a six month operational period on the planet's surface. These doses are upper bound calculations for each case considered, and the totals are upper bounds which may be used to establish rationale concerning the use of gamma radiation for spacecraft sterilization purposes. Author

N71-15903*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AN EARTH-MARS MISSION-ANALYSIS PROGRAM

James F. Kibler Washington Jan. 1971 74 p refs

(NASA-TN-D-5985; L-7213) Avail: NTIS CSCL 22A

A rapid, flexible, preliminary Earth-Mars mission analysis computer program was developed. The program computes a conic interplanetary trajectory approximation, a noncoplanar impulsive deboost maneuver into a closed orbit about the target planet, and many mission-dependent and mission-independent parameters to allow examination of the entire flight profile. The capabilities of the program are discussed along with the requirements for computing a general planet-to-planet mission. Examples of program input and output and sample data analyses are presented for an Earth-Mars mission during the 1973 launch opportunity. A flow diagram for the main program, the input and output description, and a complete program listing are presented in the appendixes. Author

N71-15990* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

METHOD OF PLANETARY ATMOSPHERIC INVESTIGATION USING A SPLIT-TRAJECTORY DUAL FLYBY MODE Patent

John M. Coogan, inventor (to NASA) Issued 6 Oct. 1970 (Filed 15 Dec. 1967) 9 p Cl. 356-74; Int. Cl. G01j3/00

(NASA-Case-XAC-08494; US-Patent-3,532,428;

US-Patent-Appl-SN-690998) Avail: US Patent Office CSCL 22C

A method of investigating the atmosphere of a remote target planet comprising launching from Earth a pair of attached instrument platforms on a trajectory toward the target planet. The platforms are separated in space with sufficient thrust that the platforms fly by opposite sides of the planet such that the line of sight between the pair sweeps over a range of planet altitudes. Radiation from one platform is directed onto a radiation detector aboard the other platform to obtain a measure of the absorption of the radiation in travelling between the pair of platforms. From the absorption measurements and knowledge of the position of the pair of platforms relative to the target platform, the constitution and density of the atmosphere may be determined as a function of altitude without entry of the atmosphere and possible biological contamination thereof. Official Gazette of the U.S. Patent Office

N71-16034*# Cornell Univ., Ithaca, N.Y. Center for Radiophysics and Space Research.

VENUS HALO: PHOTOMETRIC EVIDENCE FOR ICE IN THE VENUS CLOUDS

Brian O'Leary Apr. 1970 21 p Submitted for publication

(Grants NGL-33-010-005; NGR-33-010-082; NGR-33-010-122; NSF GA-10836)

(NASA-CR-116124; CRSR-382) Avail: NTIS CSCL 03B

Photometric observations of Venus near the 1969 inferior conjunction indicate an anomalous brightening of about 0.07 magnitude at 158 deg phase angle. The width of the brightness maximum is about 3 deg and its peak is between 1.1 and 4.4 standard deviations, depending on color, from the expected background phase curve. These results tend to confirm earlier observations which marginally showed the same brightness maximum. This is precisely the behavior expected if the Venus cloud tops were to contain a small abundance (a few percent) of hexagonal water-ice crystals, producing a halo effect analogous to the common terrestrial 22 deg halo phenomenon. Proof of such a halo effect causing Venus' brightening cannot be considered as unequivocal, but the observations are certainly provocative enough to conclude there is strong evidence that some of the Venus cloud tops contain hexagonal ice. Author

N71-16080* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

POSITION LOCATION AND DATA COLLECTION SYSTEM AND METHOD Patent

Charles R. Laughlin, Jr., Gay E. Hilton, Richard C. Lavigne, and Roger C. Hollenbaugh, inventors (to NASA) Issued 7 Oct. 1969 (Filed 22 May 1967) 20 p Cl. 343-6; Int. Cl. G01s9/00, 1/30, 9/56

(NASA-Case-GSC-10063-1; US-Patent-3,471,858;

US-Patent-Appl-SN-641431) Avail: US Patent Office CSCL 09F

A system for telemetering the position of a plurality of remote objects to a central station comprises a plurality of very low frequency transmitting stations for emitting isophase signals that are picked up by receivers on the objects. The very low frequency received signals are converted to VHF signals, that are relayed to the central station via a synchronous satellite. At the central station, the received signals are processed to derive indications of the remote object positions.

Official Gazette of the U.S. Patent Office

N71-16201# Army Foreign Science and Technology Center, Washington, D.C.

THE SEARCH FOR SIGNALS OF EXTRATERRESTRIAL LIFE

V. Troitskii 19 Jun. 1970 11 p Transl. into ENGLISH from Astron. Koemonavt. (USSR), no. 8, 1968 p 77-80

(AD-713920; FSTC-HT-23-009-70) Avail: NTIS CSCL 6/3

The search for signals of extraterrestial life is connected with the general problem of existance and distribution of intelligent life in the universe, which for a long time was a province of science fiction or at the most a province of speculative conclusions. However recently it became an object of scientific research. More than that, a portion of the problem which relates to the form of life of the planets of the solar system has already been partially solved. On the basis of astronomical, radioastronomical, and direct experimental research, it can be concluded that not only do civilizations not exist on the nearest planets of the solar system, but even the existence of simple forms of life there is questionable. Author (GRA)

N71-16239*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RADIO ASTRONOMY EXPLORER-1 DATA DISPLAYS
M. L. Kaiser Aug. 1970 21 p refs
(NASA-TM-X-65415; X-693-70-326) Avail: NTIS CSCL 03B

Access to the RAE-1 data is primarily in the form of computer generated microfilm plots. The material presented is aimed at providing the users of the data with a precise understanding of what each plot displays. Descriptions are given for the RAE-1 data displays and all variables pertinent to their interpretation are explained or defined. D.L.G.

N71-16240# Rice Inst., Houston, Tex. Dept. of Space Science
THEORETICAL NUCLEAR ASTROPHYSICS Final Report, Oct. 1967 – Sep. 1970
Donald D. Clayton 29 Sep. 1970 29 p refs
(Grant AF-AFOSR-1363-68)
(AD-714097; AFOSR-70-2519TR) Avail: NTIS CSCL 3/2

The great preponderance of this research has been directed toward the many ramifications of a single problem -- to evaluate the nuclear data for and against the proposition that the chemical elements have been created by nuclear reactions in stars. Results are discussed. GRA

N71-16270# Cornell Univ., Ithaca, N.Y. Center for Radiophysics and Space Research.
QUASAR MODELS AND NEBULAE Final Report, 1 Jul. 1967 – 30 Sep. 1970
Thomas Gold Oct. 1970 13 p refs
(Contract N00014-67-A-0077-0007)
(AD-714110; CRSR-406) Avail: NTIS CSCL 3/2

The report summarizes work done on quasars, radio galaxies, pulsars, and the background microwave radiation. Theories and interesting observations are offered in reference to these topics. A bibliography follows the text. GRA

N71-16325# Naval Weapons Lab., Dahlgren, Va. Warfare Analysis Dept.
EFFECT OF TRUNCATION OF GRAVITY FIELD ON COMPUTED SATELLITE ORBITS
Carol W. Malyevac Sep. 1970 33 p refs
(AD-713918; NWL-TR-2373) Avail: NTIS CSCL 22/3

The simulated effects on computed satellite orbits of the truncation of the series expansion for the earths gravity field are found. Twice the rms effect of gravity coefficients above 12th degree and order on the computed orbit of a satellite at a height of 600 nautical miles is found to be less than 23 meters during a 24 hour period provided that (1) the rms of the gravity coefficients of degree n obeys the observed decay law of 10 to the minus 5th power/n squared for fully normalized coefficients, (2) resonance effects on the orbit are ignored and (3) the gravity coefficients up to the point of truncation are perfect. Under the same conditions, twice the rms effect decreased to 4 meters for a 600 mile orbit with 20th degree truncation. The maximum increased to 120 meters for a 200 mile orbit with 12th degree truncation. Author (GRA)

N71-16511# Joint Publications Research Service, Washington, D.C.
ASTRONOMY
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 243 30 Dec. 1970 p 1 – 4 (See N71-16510 06-13)
Avail: NTIS

News items and research abstracts on the following topics are summarized: possibilities of extraterrestrial life, plane polarization of pulsar MP 0628, atmospheric trajectories of meteors, and Martian radio emission measurements. E.C.

N71-16515# Joint Publications Research Service, Washington, D.C.
UPPER ATMOSPHERE AND SPACE RESEARCH
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 243 30 Dec. 1970 p 36 – 58 (See N71-16510 06-13)
Avail: NTIS

News items and research abstracts on space flight operations and scientific investigations are presented. Space flight data are given on Lunokhod-1, Luna-17, Vertikal-1, Molniya-1, and Cosmos-379 through Cosmos-383. Scientific investigations concern laser ranging of the moon, E sub s formation, flywheel control of body orientation, star altitude measurement of earth satellite motion, geomorphological and geological space photointerpretation, resonance drift in magnetosphere, and high energy particle interaction with neutral layer. E.C.

N71-16671*# Jet Propulsion Lab., Calif. Inst. of Tech., Calif.
SPACE PROGRAMS SUMMARY NO. 37-65, VOLUME 3 FOR THE PERIOD 1 AUGUST – 30 SEPTEMBER 1970 SUPPORTING RESEARCH AND ADVANCED DEVELOPMENT
31 Oct. 1970 201 p refs
(Contract NAS7-100)
(NASA-CR-116228; JPL-SPS-37-65-Vol-3) Copyright. Avail: NTIS CSCL 22A

Research progress is reported on optimal methods for computing the incomplete gamma and related functions, a system of computer programs for interactive trajectory design, computer refreshed display systems, space communicaton systems, spacecraft antennas, spacecraft power supplies, guidance and control analysis and integration, attitude control simulator for TOPS spacecraft, materials for spacecraft antenna, electronic packaging and cabling, data systems for spacecraft, sonic boom tests in supersonic wind tunnels, solid propellant engineering, polymer materials, liquid propulsion technology, and tracking and orbit determination. For individual titles, see N71-16672 through N71-16690.

N71-16690*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING AND ORBIT DETERMINATION
In its Space Programs Sum. No. 37-65, Vol. 3, Aug. – Sep. 1970 31 Oct. 1970 p 182 – 190 refs (See N71-16671 06-30)
Copyright. Avail: NTIS CSCL 22A

By considering and solving specific electromagnetic (EM) problems in noninertial frames, more insight and understanding of the present covariant EM theory is obtained together with relativity theory. Such a study may lead to investigation into classical field theory and may provide useful information concerning radiation phenomena in the universe. Also, since the electrodynamics of moving media has recently become of interest, one simple case of EM propagation in a uniformly accelerated simple medium is generalized for arbitrary initial propagation direction. Unlike some works that use null geodesics, or mathematically equivalent refraction indices, to get the optical path, the physically measurable medium constitutive parameters in the comoving frame are inserted into the local Maxwell equations and all the propagation properties are found. A detailed solution for the parallel electric mode in the high-frequency, low-acceleration case is given. Author

N71-16744# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ASTRODYNAMIC CHARACTERISTICS OF FLIGHT ON THE COURSE EARTH-MOON-EARTH
H. A. Ryabov 24 Aug. 1970 15 p Transl. into ENGLISH from Zemlya I Vselennaya (USSR), no. 4, 1969 p 12 – 16
(AD-714426; FTD-MT-24-177-70) Avail: NTIS CSCL 22/2

The article discusses problems associated with sending Zond 5 and Zond 6 to the moon, as well as the American

spaceship Apollo 8. Certain criteria must be met to put the space vehicles on the right course to the moon. Corrections in flight trajectory were successfully made during flights of Zond 5 and Zond 6. The first correction of Zond 5 was made at 325,000 km from earth. The moons attraction also has considerable effect on the trajectory of flight around the moon. The problem of getting back on course to the earth and then soft landing is considered. The original article has five figures. GRA

N71-16757*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ON THE NATURE AND ORIGIN OF DIRECTIONAL DISCONTINUITIES

Leonard F. Burlaga Nov. 1970 19 p refs Submitted for publication

(NASA-TM-X-65430; X-692-70-462) Avail: NTIS CSCL 03B

Less than 25 percent of the directional discontinuities (directional changes greater than 30 deg in less than 30 sec) identified in the interplanetary magnetic field data from Pioneer 6 are Alfven shocks (rotational discontinuities). Thus, most of these directional discontinuities are tangential. The Pioneer 6 magnetic field and plasma data are not consistent with the hypothesis that directional discontinuities originate primarily by the collision of fast streams with slower plasma, since the rate of occurence of discontinuities in regions of increasing bulk speed is only a little higher than the rate elsewhere. The rate at which discontinuities are seen at .82 AU, is somewhat lower than at 1 AU, but the difference may be due to the lower data quality and increase in the number of data gaps when the spacecraft is far from the earth. The distributions of the change in direction of the field across the discontinuity and of the normals are essentially the same at .8, .9 and 1.0 AU. This suggests that most discontinuities originate within .8 AU and do not evolve appreciably between .8 and 1.0 AU. Author

N71-16758# Naval Weapons Lab., Dahlgren, Va.

OPTIMUM INTEGRATION INTERVAL FOR USE IN ORBIT COMPUTATIONS WITH THE NRL-9 GRAVITATIONAL PARAMETER SET

Jane V. Robinson Sep. 1970 29 p refs

(AD-714142; NWL-TR-2478) Avail: NTIS CSCL 22/3

New gravitational parameter sets, generated to produce a better model of the earths gravitational field, include maximum degree and order of the parameters associated with the cosine and sine terms as high as 19 and 27 respectively. Using one such gravity field solution (NWL 9A), tests were conducted to determine optimum integration intervals for near polar satellites at low (100 n.m.), medium (500 n.m.), and high (11,000 n.m.) altitudes. Through comparisons of trajectories integrated at various intervals, an optimum interval of 30 seconds was selected for the 100 n.m. altitude satellite, 60 seconds for the 500 n.m. altitude satellite, and 640 seconds for the 11,000 n.m. altitude satellite. An orbit difference of approximately 0.1 meter for a span of 2 days was considered to be satisfactory for use in orbit computations. (Graphical illustrations of these comparisons for the different satellites are presented in the appendices). In the study of the 11,000 n.m. altitude satellite, instability in the numerical integration process used in orbit computations was shown to occur for integration intervals of approximately 720 seconds and larger. Author (GRA)

N71-16765*# Bellcom, Inc., Washington, D.C.

AN ANALYTICAL SOLUTION TO SWING-BY TRAJECTORIES

K. M. Carlson 28 Dec. 1970 28 p ref

(Contract NASw-417)

(NASA-CR-116197; B70-12075) Avail: NTIS CSCL 22A

An analytical solution is derived to the problem of trajectories which encounter the Moon or a planet and must satisfy conditions before and after the encounter. Such trajectories include free-return and fly-by trajectories. The analysis is based on an analytical solution to patched-conic trajectories developed previously by the author. The conditions to be met are pre-encounter and post-encounter inclination and angular momentum. The trajectory energy referenced to the encountered body and the time of the encounter must also be known. Author

N71-16766*# Bellcomm, Inc., Washington, D.C.

AN ANALYTICAL SOLUTION TO PATCHED CONIC TRAJECTORIES SATISFYING INITIAL AND FINAL BOUNDARY CONDITIONS

K. M. Carlson 30 Nov. 1970 81 p refs

(Contract NASw-417)

(NASA-CR-116226; TM-70-2011-1) Avail: NTIS CSCL 22C

Analytical expressions for patched-conic trajectories are derived, thus providing the analyst with a tool for the calculation of spacecraft trajectories between two bodies and for understanding the behavior of these trajectories as the mission constraints are varied. Two sets of equations are developed which allow an analytical solution to spacecraft trajectories between two large central bodies and which satisfy boundary conditions at both bodies. The derivations of these equation sets are based on patched-conic analysis. The independent parameters required are the spacecraft angular momentum and inclination with respect to the more massive body, and the spacecraft angular momentum, energy, and inclination with respect to the less massive body, or equivalent quantities. These equation sets provide a good approximation to the sphere of influence trajectory patch point over essentially the entire range of possible trajectories. Having obtained the patch point, the spacecraft state vector is easily obtained. Author

N71-16785*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Mission Analysis Div.

POLYNOMIAL EXPRESSIONS FOR PLANETARY EQUATORS AND ORBIT ELEMENTS WITH RESPECT TO THE MEAN 1950.0 COORDINATE SYSTEM

Francis M. Sturms, Jr. 15 Jan. 1971 28 p refs

(Contract NAS7-100)

(NASA-CR-116207; JPL-TR-32-1508) Avail: NTIS CSCL 03B

Expressions are presented for the mean orbital elements of the nine planets with respect to the mean equinox and ecliptic of 1950.0. Also, expressions are presented for the right ascension and declination of the north pole of each of the nine planets with respect to the mean equinox and Earth equator of 1950.0. The expressions are polynomials in time T measured in Julian centuries from the epoch January 1.0, 1950 E.T. The expressions are useful for coordinate transformations and approximate planetary ephemerides in astrodynamic computer programs. Author

N71-16783 Rochester Univ., N.Y.

ON THE AXIAL ALIGNMENT OF INTERSTELLAR DISTURBANCES IN THE NUCLEI OF VARIABLE GALAXIES

Patricia Ann Andre Clark (Ph.D. Thesis) 1969 91 p

Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 70-1855

The central regions of variable galaxies characteristically exhibit: (1) axially aligned paired structures in the disturbed interstellar medium; (2) explosive variability in the light output; and (3) rapid rotation. Two major problems in the explanation of these observations are the origin of the explosive energy release and the mechanism for the axial alignment. It is shown that the basic rotation of the galaxy may provide the alignment. The model chosen for the study of the interstellar gas motions in the galactic nuclear

region incorporates the uniform temperature gas in equilibrium in the gravitational field of the massive co-rotating stellar system. The equilibrium situation is disturbed by a small-scale explosive event which affects only the gas motions. Dissert. Abstr.

N71-16784 Cornell Univ., Ithaca, N.Y.
PHYSICAL ADSORPTION AND THE MOLECULAR HYDROGEN DENSITIES OF INTERSTELLAR CLOUDS
David John Hollenbach (Ph.D. Thesis) 1969 201 p
Avail: Univ. Microfilms: HC $9.25/Microfilm $3.00 Order No. 69-21613

Three parameters important to the theoretical problem of physical adsorption are studied with special attention given to the cases of light adsorbing gases and low surface temperatures where quantum mechanical effects are important. These parameters are: (1) the sticking coefficient; (2) the binding energy; and (3) the surface mobility. Particular values of these parameters are calculated and used to determine the rate of hydrogen molecule formation by association of atomic hydrogen adsorbed to interstellar dust grains. It has been suggested that molecule formation on ice surfaces of interstellar grains cannot occur if the grain temperature is above 8 K because evaporation precedes molecule formation. However, the new values of the parameters, coupled with consideration of the effect of impurities and surface defects, show that molecule formation can occur efficiently to grain temperatures as high as 30 K. Dissert. Abstr.

N71-16828 Georgetown Univ., Washington, D.C.
A CATALOG OF POSITIONS AND PROPER MOTIONS OF 310 STARS IN THE REGIONS OF TAURUS AND ORION
Clayton Albert Smith, Jr. (Ph.D. Thesis) 1969 80 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 70-4643

New mean positions and proper motions on the system of the FK4 were derived for 310 stars in List I of stars in the Taurus and Orion regions. These stars are in the 7th to 9th magnitude range and were especially selected to serve as a grid for use in photographic studies of the Taurus and Orion associations. The catalog gives the mean right ascension and declination of each star for the epoch and equinox 1950.0, centennial values of the proper motions and their mean errors, the mean epochs of the right ascensions and declinations used in the solution and their mean errors at their respective mean epochs. In addition, magnitude, spectral type, Durchmusterung number, and the number in Parenge's 1954 list are given as a matter of convenience for the user. Dissert. Abstr.

N71-16829 Michigan Univ., Ann Arbor.
THE SPACE DISTRIBUTION AND KINEMATICS OF SUPERGIANT STARS
Roberta Marie Humphreys (Ph.D. Thesis) 1969 170 p
Avail: Univ. Microfilsm: HC $7.80/Microfilm: $3.00 Order No. 70-4106

The space distribution and kinematics of the supergiant stars of all spectral types have been investigated with special emphasis on the problem of the correlation of these young stars and the interstellar gas. Specifically the M supergiants have been studied as spiral arm tracers. New observational data, including radial velocities from infrared spectra, have been obtained for 45 known M supergiants in the Perseus arm. In addition 13 new M supergiants were found in that spiral arm. Over 60% of the supergiants were found to be members of either stellar associations or galactic clusters, but relative numbers of blue and red supergiants present in these stellar groups do not permit a definite decision on the problem of neutrino processes in M supergiants. Dissert. Abstr.

N71-16830 Case Western Reserve Univ., Cleveland, Ohio.
A SPECTROSCOPIC INVESTIGATION OF VISUAL BINARIES WITH B-TYPE PRIMARIES
Robert Earl Murphy (Ph.D. Thesis) 1969 53 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 70-4960

The absolute magnitudes of B stars have been investigated using visual binaries with B-type primaries. A new calibration is presented for the main sequence stars of types BO.5-B9 and new data on the absolute magnitudes of several classes of giants and supergiants are included. The new main sequence calibration has been obtained independently of galactic structure considerations and it is independent of previous calibrations using galactic clusters. The new main sequence is systematically fainter than that of Johnson and Iriarte (1958) but brighter than those of Weaver and Ebert (1964) and Fitz-Gerald (1969). Four of the secondaries are peculiar A stars. Their presence in systems with main sequence B stars implies that they are not highly evolved objects. Dissert. Abstr.

N71-16858# National Aeronautics and Space Council, Washington, D.C.
AERONAUTICS AND SPACE REPORT OF THE PRESIDENT, JANUARY 1971
GPO Jan. 1971 118 p refs Presented to Congr., Jan. 1971
Avail: SOD: $1.25

New goals and objectives for continuing the progress of space achievements were announced based on three general purposes: space exploration, scientific knowledge and practical applications. Six specific objectives were outlined: (1) continued exploration of the moon; (2) bold exploration of the planets and the universe; (3) substantial reduction in the cost of space operations; (4) extension of man's capability to live and work in space; (5) expansion of the practical applications of space technology and (6) the encouragement of greater international cooperation in space. Author

N71-16860*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A PASSIVE METHOD FOR SCANNING THE CELESTIAL SPHERE
Albert J. Fleig, Jr. Washington Feb. 1971 7 p refs
(NASA-TN-D-5611) Avail: NTIS CSCL 03B

A passive method for scanning the celestial sphere which is applicable to missions requiring long lifetime and moderate pointing accuracies is described herein. The spacecraft is spin stabilized and it is the spin axis which is caused to follow the scan pattern. The scan is obtained by combining the gravity gradient induced precession of the spacecraft's spin axis about its orbit pole with the oblateness induced precession of the orbit pole. The parameters directly affecting a particular mission are the orbit altitude, inclination, and eccentricity and the body spin rate, cone angle and inertia difference. Design curves which can be used for parameter trade-off studies of these factors are included. Author

N71-16861*# Translation Consultants, Ltd., Arlington, Va.
THERMAL RADIATION FROM THE MOON AND THE PHYSICAL PROPERTIES OF ITS UPPER MANTLE [TEPLOVOYE IZLUCHENIYE LUNY I FIZICHESKIYE SVOYSTVA YEYO VERKHNEGO POKROVA]
V. S. Troitskiy et al Washington NASA Jan. 1971 64 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiofiz. (Gorkiy), v. 13, no. 9, 1970 p 1273–1311
(Contract NASw-2038)
(NASA-TT-F-13455) Avail: NTIS CSCL 03B

Investigations made of the moon's natural emissions, and of the reflection of radio waves from its surface, are summarized by type. A modern model of the structure of the upper mantle of the moon, based on available experimental data, and on the methods developed to interpret these data, is presented. Author

N71-16882*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ELECTRICAL CONDUCTIVITY AND TEMPERATURE OF THE LUNAR INTERIOR FROM MAGNETIC TRANSIENT RESPONSE MEASUREMENTS

Palmer Dyal, Curtis W. Parkin, Charles P. Sonnett, and David S. Colburn Dec. 1970 59 p refs

(NASA-TM-X-62012) Avail: NTIS CSCL 03B

The response of the moon to magnetic-field step transients in the solar wind has been investigated for seventy-five events, using simultaneous data from the Apollo 12 lunar surface magnetometer and the lunar orbiting Explorer 35 magnetometer. The lunar-nighttime Apollo 12 magnetometer data consistently show a distinct difference between radial and tangential surface magnetic-field components for all step transients. The simplest model which qualitatively explains all the general aspects of the dark-side transient-response data is a spherically symmetric three-layer model having a thin outer crust of very low electrical conductivity. The intermediate layer, of radial thickness R sub 1 - R sub 2, has an electrical conductivity sigma sub 1 = 0.4 × 0.0001 mhos/meter; the inner core has a minimum conductivity sigma sub 2 approximately 0.01 mhos/meter. Temperatures are calculated from these conductivities for several possible lunar material compositions. Author

N71-16883*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ON A TRANSFORMATION OF THE DIFFERENTIAL EQUATIONS OF THE LUNAR THEORY

Peter Musen Washington Feb. 1971 35 p refs

(NASA-TN-D-7036; G-1007) Avail: NTIS CSCL 03B

The Hill-Brown differential equations of satellite coordinates are transformed to a type which can be integrated using an analytic programming language. The differential equation for the parallax of a satellite is also established. Its use facilitates computation of Hill's periodic intermediary orbit and provides a good check for the expansion of the coordinates and frequencies. Knowledge of the expansion of the parallax facilitates the formation of differential equations for terms with a given characteristic. These differential equations are put into a form solvable by iteration on the computer. Obtained are expansions of the coordinates and parallax in the form of trigonometric series in four arguments and in powers of the constants of integration. Only the zero order terms in these expansions are used to integrate the differential equations. The remaining terms produce the cross-effects between perturbations of different order. The averaging operation is applied to the right sides of the differential equations to deduce the expansion of the frequencies in powers of squares of the constants of integration. Author

N71-16880*# Northrop Corp., Huntsville, Ala. Electro-Mechanical Div.

PRELIMINARY STUDY OF MINIMUM PERFORMANCE APPROACHES TO AUTOMATED MARS SAMPLE RETURN MISSIONS Final Report, 19 Oct - 20 Nov. 1970

P. R. Odom, D. R. Spence, H. A. Cikanek, B. G. Brown, and L. C. Allen Nov. 1970 240 p refs

(Contract NAS8-26656)

(NASA-CR-103009; TR-793-842) Avail: NTIS CSCL 22A

A preliminary study was performed to identify and define promising alternative mission/system approaches to automated Mars surface sample return (MSSR) missions based on utilization of Titan 3 or Saturn Intermediate-20 (S-IC/S-4B) class launch vehicles. The 1975, 1977, and 1979 launch opportunities were considered in conducting broad parametric performance analyses to establish gross earth departure weight requirements as a function of sample return weight for candidate mission modes employing all-chemical or solar-electric/chemical spacecraft propulsion. Three earth departure modes were considered: (1) single launch, (2) earth orbit rendezvous where the MSSR spacecraft is mated with a Centaur orbital transplanetary injection stage in earth orbit, and (3) multiple or dual interplanetary departure where the lander/ascent probe(s) and orbiter/bus return vehicle are launched to Mars as separate payloads. Author

N71-16881*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

TRACKING SYSTEM ANALYTIC CALIBRATION ACTIVITIES FOR THE MARINER MARS 1969 MISSION

B. D. Mulhall, C. C. Chao, N. A. Mottinger, P. M. Muller, V. J. Ondrasik et al 15 Nov. 1970 76 p refs

(Contract NAS7-100)

(NASA-CR-116248; JPL-TR-32-1499) Avail: NTIS CSCL 22C

The functions are described of the Tracking System Analytical Calibration activity of the Deep Space Network in support of an entire mission and, in particular, the Mars encounter phase of the Mariner Mars 1969 mission. The support functions encompass calibration of tracking data by estimating physical parameters whose uncertainties represent limitations to navigational accuracy; validation of the calibration data and utilization of these data during a mission; and detailed postflight analysis of tracking data to uncover and resolve any anomalies. Separate articles treat tracking system improvements presently under consideration and error source reductions that may be realizable for future missions; solutions for Deep Space Stations locations; timing errors and polar motion; methods of correcting the tracking data for charged-particle effects (ionospheric corrections); and a model of tropospheric refraction. Author

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N71-16812# Royal Aircraft Establishment, Farnborough (England).

TABLE OF SPACE VEHICLES LAUNCHED BEFORE SEPTEMBER 1970

H. Hiller and J. A. Pilkington (Scarborough Planetarium) Sep. 1970 28 p refs

(RAE-TR-70163) Copyright. Avail: NTIS

All known space vehicles launched before September 1970, except satellites in geocentric orbits, are tabulated with data on mass, size, shape, orbit, and time of launch. The four sections are (1) heliocentric orbits, (2) orbits in the earth-moon system, (3) selenocentric orbits earth launch, and (4) selenocentric orbits - moon launch. Author (ESRO)

N71-16821# European Space Research and Technology Center, Noordwijk (Netherlands).

DYNAMIC CHARACTERISTICS OF A SOLAR ACQUISITION

SYSTEM [PARTICULARITES DYNAMIQUES D'UNE ACQUISITION SOLAIRE]

M. Guerin Paris ESRO Dec. 1969 29 p In FRENCH; ENGLISH summary
(ESRO-TN-96-ESTEC) Avail: NTIS

Some of the dynamical difficulties encountered in aligning satellites along a given reference e.g. acquisition phase of a sunpointing mission, which can lead either to a failure of acquisition or to exceedingly long acquisition times, are analyzed. Appropriate solutions are proposed for each particular case. Author (ESRO)

N71-15899*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THORAD-AGENA PERFORMANCE FOR THE ORBITING GEOPHYSICAL OBSERVATORY 6 MISSION

Washington Jan. 1971 77 p refs
(NASA-TM-X-2148; E-5639) Avail: NTIS CSCL 22A

The Thorad-Agena launch vehicle successfully placed the Orbiting Geophysical Observatory 6 into an elliptical orbit with a perigee altitude of 399 km and an apogee altitude of 1099 km, at an inclination of 82 deg to the equator. The spacecraft, an instrumented earth-orbiting satellite, was launched in June 1969 for the purpose of conducting a series of scientific experiments. The performance of the Thorad-Agena system in support of the OGO-6 mission is evaluated. Author

N71-16080* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

SPACECRAFT RADIATOR COVER Patent

Joseph A. Chandler, inventor (to NASA) Issued 9 Sep. 1969 (Filed 26 Dec. 1967) 5 p Cl. 52-3; Int. Cl. E04h14/00; Int. Cl. F42b15/10
(NASA-Case-MSC-12049; US-Patent-3,465,482; US-Patent-Appl-SN-693420) Avail: US Patent Office CSCL 22B

The invention relates to a protective covering for use on a spacecraft where it is necessary to prevent degradation of the thermal control coating during assembly of the spacecraft and prior to and during launch, the invention comprises a cover made of a high strength, high temperature plastic film which is secured to an edge member frame which encircles the radiator surface, the edge member is bonded with a fairly brittle adhesive system to the edge of the radiator surface, in the center of the edge member is an explosive, mild detonating fuse, sized so that when detonated it will expand the edge member, but will not cause it to rupture. Official Gazette of the U.S. Patent Office

N71-16081* Geophysics Corp. of America, Bedford, Mass.

INFLATION SYSTEM FOR BALLOON TYPE SATELLITES Patent

John M. Thole, Wallace S. Kreisman, and Robert M. Chapman, inventors (to NASA) Issued 4 Oct. 1966 (Filed 16 Jul. 1965) 11 p Cl. 244-31 Sponsored by NASA
(NASA-Case-XGS-03351; US-Patent-3,276,726; US-Patent-Appl-SN-472747) Avail: US Patent Office CSCL 22B

A method for inflating balloon type satellites in an orbital environment is presented. The method comprises the packaging of a chemical to be sublimated in a large number of individually sealed inflation packages which are distributed over the inner wall of the satellite. The sealed inflation packages contain thin wafers of the chemical to be sublimated with the wafers being sandwiched between a vapor tight plastic sheet and a perforated plastic filler which serves to control the rate of vapor flow from the package. NASA

N71-16085* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

OMNIDIRECTIONAL MULTIPLE IMPACT LANDING SYSTEM Patent

John R. McGehee, inventor (to NASA) Issued 14 Jul. 1970 (Filed 5 Mar. 1968) 7 p Cl. 244-138; Int. Cl. B63b7/08; Int. Cl. B64d1/08; Int. Cl. F16d63/00
(NASA-Case-XLA-09881; US-Patent-3,520,503; US-Patent-Appl-SN-710562) Avail: US Patent Office CSCL 22B

A payload landing system using a stowable, protective gas bag is described. The system has multiple impact capability for ensuring the soft landing of fragile objects such as instrument packages. E.C.

N71-16102* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SELF-ERECTING REFLECTOR Patent

Hossein Bahiman, John D. Gates, and William Korvin, inventors (to NASA) Issued 21 Jul. 1970 (Filed 16 Jun. 1967) 6 p Cl. 343-915; Int. Cl. H01q15/20
(NASA-Case-XGS-09190; US-Patent-3,521,290; US-Patent-Appl-SN-647298) Avail: US Patent Office CSCL 22B

A collapsible antenna structure having a reflector of a continuous high modulus mesh with a plurality of radially extending mesh ribs integrally attached to the convex side is described. The self-erectable antenna elements are designed to be packaged as low volume units to be deployed to an expanded operational shape. Official Gazette of U.S. Patent Office

N71-16221* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

DETECTOR PANELS-MICROMETEOROID IMPACT Patent

James W. Mayo and Walter M. Cook, Jr., inventors (to NASA) Issued 1 Sep. 1970 (Filed 21 Nov. 1968) 5 p Cl. 73-432; Int. Cl. G01d21/00
(NASA-Case-XLA-5906; US-Patent-3,526,139; US-Patent-Appl-SN-777766) Avail: US Patent Office CSCL 22B

A large area meteoroid detector panel fabricated from two sheets of metal attached together to form a pressure vessel which contain a plurality of cells and one or more sensing devices. Meteoroids penetrating one of the shuts cause a loss of pressure within the panel which loss is detected by one of the sensing devices. Official Gazette of the U.S. Patent Office

N71-16222* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

METHOD AND APPARATUS FOR SECURING TO A SPACECRAFT Patent

Alfred P. Warren and William R. Lauderdale, inventors (to NASA) Issued 28 Apr. 1970 (Filed 26 Dec. 1967) 7 p Cl. 244-1; Int. Cl. B64g1/20; Int. Cl. B64d39/00
(NASA-Case-MFS-11133; US-Patent-3,508,723; US-Patent-Appl-SN-693419) Avail: US Patent Office CSCL 22B

A method and apparatus for connecting two spacecraft together by inserting a probe on one spacecraft into the rocket engine nozzle of the other spacecraft and expanding the device laterally in order to secure directly to the nozzle of the rocket engine. The apparatus utilizes a probe having power driven locking shoes mounted on it. The locking shoes are arranged to be retracted while the probe is being inserted into the nozzle. The shoes may than be expanded laterally by gas or hydraulic pressure to lock to the throat of the nozzle. Two embodiments of the device are disclosed, one designed to fit a particular size and type of rocket engine and the other designed as a universal type securing device which will fit a variety of types and sizes of rocket engines. Official Gazette of the U.S. Patent Office

N71-16326# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

LUNA 16: AN OUTSTANDING NEW ACHIEVEMENT OF SOVIET SPACE SCIENCE
13 Oct. 1970 23 p Transl. into ENGLISH from Izvestiya (USSR), Oct. 1970 p 1–4
(AD-714428; FTD-HT-23-744-70) Avail: NTIS CSCL 22/2

A popularized account is given of the flight of the Luna-16 automatic space station. Topics include: Execution of the flight program; Operation on the lunar surface; Return to earth; Handling and study of the lunar core samples on earth. GRA

N71-16333# Naval Research Lab., Washington, D.C.
INTERKOSMOS-3 RESEARCH SATELLITE ORBITED BY SOVIET-CZECH TEAM [INTERKOSMOS-3 V POLETE]
8 Oct. 1970 5 p Transl. into ENGLISH from Pravda (Bratislava), no. 220 8 Aug. 1970 p 1
(AD-713859; NRL-Trans-1222) Avail: NTIS CSCL 4/1

Interkosmos-3, an artificial earth satellite, was launched 7 August 1970 from the Soviet Union as part of a program for cooperation between Socialist countries in the study and utilization of outer space for peaceful purposes. Author (GRA)

N71-16345* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SERPENTUATOR Patent
Hans F. Wuenscher, inventor (to NASA) Issued 14 Jul. 1970 (Filed 1 Feb. 1968) 11p Cl. 244-1; Int. Cl. B64g1/00
(NASA-Case-XMF-05344; US-Patent-3,520,496; US-Patent-Appl-SN-702396) Avail: US Patent Office CSCL 22B

A Serpentuator is defined as a system for an orbital space station that includes internal and external serpentine devices for performing physical operations such as positioning personnel and tools around the space station. Each device consists of a group of cylindrical links pivotally connected at their ends and includes servo-actuators connected between adjacent links for controlling the angular relationships of the links relative to one another. The external device has one end mounted to the space station and the internal device has a clamp on one end for attachment to various parts of the space station or to the unattached end of the external device. Official Gazette of the U.S. Patent Office

N71-16346* North American Aviation, Inc., El Segundo, Calif.
EXPANDING CENTER PROBE AND DROGUE Patent
Crosby E. Fentress, inventor (to NASA) Issued 1 Sep. 1970 (Filed 27 Feb. 1969) 7 p Cl. 244-1; Int. Cl. B64g1/00 Sponsored by NASA
(NASA-Case-XMS-03613; US-Patent-3,526,372; US-Patent-Appl-SN-802816) Avail: US Patent Office CSCL 22B

A cooperating probe and drogue assembly for mechanically linking respective space vehicles upon completion of rendezvous maneuvers is described. The proble, which is mounted at an end of one of the vehicles, is characterized by a telescoping boom which is extended or retracted by a group of arms. The end of the boom carries a contact head having capture latches which are adapted to engage a cooperating drogue mechanism on the rear of a target vehicle. Subsequent to initial coupling of the vehicles the boom is retracted to bring the vehicles into full abutting contact, where they are structurally locked to one another. Official Gazette of the U.S. Patent Office

N71-16450*# Bell Aerospace Co., Buffalo, N.Y.
APOLLO RCS POSITIVE EXPULSION TANKAGE PRODUCT IMPROVEMENT PROGRAM: CORRELATION OF REFEREE FLUID AND PROPELLANT IN VIBRATION TESTING, TASK5 Final Report, Jul. 1967 – Sep. 1969
13 Nov. 1970 47 p
(Contract NAS9-7182)
(NASA-CR-114811; Rept-8514-928005) Avail: NTIS CSCL 22B

Procedure for updating and improving the Apollo RCS positive expulsion propellant tank assemblies in the areas of performance, reliability, and mission duration are presented. A chronological summary of the evluation of the spacecraft components and other related tankage was prepared. The useful operating lifetime of the Apollo configuration RCS tanks as applicable to a mission of extended duration with a specific goal of 12 months was determined. Vibration tests of the Apollo-type bladder were conducted. Author

N71-16462*# Lockheed Missiles and Space Co., Sunnyvale, Calif. SSD Power Systems.
EVALUATION OF SPACE STATION SOLAR ARRAY TECHNOLOGY AND RECOMMENDED ADVANCED DEVELOPMENT PROGRAMS First Topical Report
28 Dec. 1970 544 p refs
(Contract NAS9-11039)
(NASA-CR-114828; LMSC-A981486) Avail: NTIS CSCL 22B

The technology and analytical techniques to support the development of a solar power system for large space stations are discussed. The goals of the program are to: (1) establish design requirements, (2) perform technology evaluation of existing techniques, (3) identify specific areas where technology advancement is needed, and (4) prepare a plan for development of the required technology. Author

N71-16787*# Louisiana State Univ., Baton Rouge. Mechanical, Aerospace, and Industrial Engineering Dept.
GRADUATE ENGINEERING PRACTICE IN MECHANICAL ENGINEERING
15 Oct. 1970 50 p refs
(Contract NAS9-10464)
(NASA-CR-114831; MSC-01500) Avail: NTIS CSCL 22B

Research projects concerning orbiter/booster separation device, minimum weight constant stress bulkhead, and orbiter propellant dump are discussed. The first task is concerned with selecting a concept and designing the apparatus to separate the two stages of the space shuttle. The second project is the design of a circular plate to be used as a propellent tank bulkhead. The third task deals with the dumping of remaining fuel on board the orbiter in the event of a launch abort. Author

N71-16788*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
A MATHEMATICAL PROCEDURE FOR PREDICTING THE TOUCHDOWN DYNAMICS OF A SOFT-LANDING VEHICLE
George A. Zupp, Jr. and Harold H. Doiron Washington Feb. 1971 84 p refs
(NASA-TN-D-7045; MSC-S-241) Avail: NTIS CSCL 22A

A mathematical procedure for simulating the touchdown dynamics of a soft-landing spacecraft is presented. The mathematical model considers the spacecraft to be a rigid body with six degrees of freedom to which several telescoping leg-type landing gears are attached. Sufficient generality is provided to account for effects from the following: strut stroking, bending, and binding; the reaction control system; descent engine thrust tailoff; descent engine nozzle crushing; and various landing-surface/landing-gear-footpad interactions. The analysis, which has been used extensively in the study of lunar module landing dynamics, is compared to experimental data from drop tests of a 1/6-scale lunar module model. Author

N71-16801*# Bell Aerospace Co., Buffalo, N.Y.
APOLLO RCS POSITIVE EXPULSION TANKAGE PRODUCT IMPROVEMENT PROGRAM: SOLUTION OF COMMAND

MODULE AND SERVICE MODULE BLADDER REPOSITIONING PROBLEMS, TASK E Final Report, Jul. 1967 – Sep. 1969
19 Mar. 1970 50 p
(Contract NAS9-7182)
(NASA-CR-114813; Rept-8514-928006) Avail: NTIS CSCL 22B

The service module bladder repositioning problem is limited to the oxidizer tank and is caused by a marginal L/D ratio. This problem exists only when repositioning the bladder after a liquid expulsion in the vertical attitude. Since this problem had been solved on the lunar module RCS and Saturn IV B APS tanks by incorporation of an undersized bladder design, it was planned to employ the same solution to the service module oxidizer tanks. Thus the activity in this phase of this task was limited to adaptation of the undersized design to the SMO bladder to be fabricated containing an aluminum foil permeation barrier previously developed
Author

N71-16802*# J. G. Engineering Research Associates, Baltimore, Md.
PREDICTION OF THE DYNAMIC ENVIRONMENT OF SPACECRAFT COMPONENTS. PART 2: ACOUSTIC AND STRUCTURAL PATH TRANSMISSION THROUGH TWO MODELS OF A SHROUD-ENCLOSED SPACECRAFT Final Report
Joshua E. Greenspon Oct. 1970 41 p refs
(Contract NAS5-10180)
(NASA-CR-116241) Avail: NTIS CSCL 22B

The structural path and acoustic path transmission of an unstiffened and stiffened shroud with spacecraft boxes contained within the shroud are discussed. The modes and frequencies of both systems were determined from a finite element program. The low frequency region below 640 cps is treated. It is found that there is not much difference in the structural path transmission between the two configurations, whereas the acoustic transmission of the unstiffened shroud is an order of magnitude greater than that of the stiffened shroud.
Author

N71-16803*# General Electric Co., Huntsville, Ala. Space Div.
DETERMINATION OF THE WIND RESPONSE OF SATURN 5 BY STATISTICAL METHODS, VOLUME 1
Dale W. Rowe, B. Gaggini, H. Graf, and D. Hurd 24 Dec. 1970 113 p refs
(Contract NAS8-25477)
(NASA-CR-103010; Rept-70-HVO-39-Vol-1) Avail: NTIS CSCL 22A

A non-stationary statistical method of estimating the response statistics of a vertically rising vehicle is presented. The method used is based on the solution of the adjoint differential equations of the vehicle. The technique is referred to as the method of adjoint systems. The method of adjoint systems has received increased attention in recent years. This increased popularity is due to more widespread recognition of the power of the method. Application of the method to the problem described in this report illustrates this power.
Author

N71-16804*# General Electric Co., Huntsville, Ala. Space Div.
DETERMINATION OF THE WIND RESPONSE OF SATURN 5 BY STATISTICAL METHODS, VOLUME 2
24 Dec. 1970 99 p
(Contract NAS8-25477)
(NASA-CR-103008; Rept-70-HVO-39-Vol-2) Avail: NTIS CSCL 22A

Computer programs for determining the wind effects on Saturn 5 launch vehicles are presented. The computer programs are an application of the method of adjoint systems.
Author

N71-16805 California Inst. of Tech., Pasadena.
VARIABLE LIFT CONTROL OF A SPACE VEHICLE DURING THE REENTRY INTO MARTIAN ATMOSPHERE
Hiroshi Ohtakay (Ph.D. Thesis) 1969 114 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 70-4297

Re-entry trajectory design problem of a space capsule into the Martian atmosphere is investigated within the context of modern control theory. The optimal control law which minimizes the heat generated on the surface of the capsule is obtained analytically. This in turn allows the capsule to make a successful softlanding on Mars through the partially known atmosphere of the planet. The investigation is also extended to the guidance of the capsule in a stochastic disturbance environment. An attempt is made to simplify the stochastic control law so that the mechanization of the resulting control law is within the grasp of current engineering technology.
Dissert. Abstr.

N71-16806*# Bellcomm, Inc., Washington, D.C.
ATTITUDE CONTROL OF DYNAMICALLY UNBALANCED ARTIFICIAL GRAVITY SPACE STATIONS
R. A. Wenglarz 28 Dec. 1970 40 p refs
(Contract NASw-417)
(NASA-CR-116227; TM-70-1022-19) Avail: NTIS CSCL 22B

Effects of dynamic unbalances are determined for an axially symmetrical, dual-spin space station consisting of a rotating artificial gravity section and a controlled, despun zero gravity section. Configurations with either a rigid interconnection or a low coupling flexible interconnection between sections are considered. Amplitudes of motion and control system requirements are compared for these configurations. Both configurations are found to experience coning motions. For large space stations with rigid interconnection, control moment gyroscopes (CMGs) are found impractical for reducing coning motions to within allowable limits for many experiments and special systems such as active mass balancing are necessary. However, for a flexible interconnection, coning motions of the despun section are substantially reduced and CMGs could be utilized to reduce motions to acceptable levels.
Author

N71-16807*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPREHENSIVE STUDY OF VENUS BY MEANS OF A LOW-COST ENTRY-PROBE AND ORBITER MISSION-SERIES
J. E. Ainsworth Jun. 1970 110 p refs Submitted for publication
(NASA-TM-X-65423; X-625-70-203) Avail: NTIS CSCL 22A

The design of low cost entry probes and orbiters for investigation of the planet Venus is discussed. Subjects presented are: (1) probe design, (2) Earth-Venus transit and Venus orbiting, (3) aeronomy and meteorology probe mission, (4) fields, particles, and aeronomy orbiter mission, (5) atmospheric circulation (balloon) mission, (6) mapping orbiter mission, (7) Venus interior examination (seismic lander) mission, and (8) Venus surface inspection (television lander) mission.
Author

N71-16808*# Scripta Technica, Inc., Washington, D.C.
FEASIBILITY STUDY OF A SINGLE-STAGE RE-USABLE BALLISTIC BOOSTER SYSTEM (BETA) [BETA: BALLISTISCHES EINSTUFIGES TRAEGER-AGGREGAT]
D. E. Koelle NASA Jan. 1971 63 p refs Transl. into ENGLISH from the German report
(Contract NASw-2036)
(NASA-TT-F-13427; UR-V-025(69)) Avail: NTIS CSCL 22B

The feasibility of a single-stage reusable launch vehicle, which for technical and economic reasons represents the simplest solution to the earth-space transport problem is investigated. The results of the studies show that such a vehicle seems possible at

the present state of the art, and that with such a device, using a launch weight of 130 tons, a payload of 2.7 to 4.2 tons can be inserted into a 200-km orbit. Author

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N71-15797# Oxford Univ. (England). Dept. of Engineering Science.

OPTIMUM DESIGN OF PIN-JOINTED FRAMEWORKS

W. S. Hemp and H. S. Y. Chan London Aeron. Res. Council 1970 29 p refs Supersedes ARC-30994

(ARC-R/M-3632; ARC-30994) Copyright. Avail: NTIS; HMSO: 14s[70p]: BIS: $2.80

A linear program for determining the layout and member sizes of frameworks, designed to carry given forces, made from material with a given allowable stress and using a minimum volume of material was formulated. The dual program is shown to lead to Michell's criteria for optimum design. A practical method of calculation, based on the dual, is presented and a computer program written in ALGOL is given. Examples include unrestricted cantilevers under tip force and distributed forces, a restricted cantilever under tip force and structures of the type required for machine tools. Author (ESRO)

N71-15868*# North Carolina State Univ., Raleigh.

ACOUSTIC RADIATION EFFICIENCY OF TRUNCATED CONICAL SHELLS

Frederick H. Ellington and Franklin D. Hart [1969] 71 p refs

(Grant NGL-34-002-035)

(NASA-CR-111840) Avail: NTIS CSCL 20K

A combined analytical and experimental study is made of the acoustic radiation efficiency of a truncated conical shell. Previous work in the acoustic radiation efficiency of cylindrical shells is utilized in order to develop an approximation technique. The conical shell is then approximated by a series of cylindrical segments and the acoustic radiation efficiency of each segment is calculated. This method yields an upper bound solution for the acoustic radiation efficiency of truncated conical shells. The experimental program verifies the fact that the method yields an upper bound solution for the acoustic radiation efficiency. Author

N71-15874* Rocketdyne, Canoga Park, Calif.

LOAD CELL PROTECTION DEVICE Patent

Raymond Keith Kibbe, inventor (to NASA) Issued 26 Aug. 1969 (Filed 19 Dec. 1967) 6 p Cl. 338-5; Int. Cl. G01l1/22 Sponsored by NASA

(NASA-Case-XMS-06782; US-Patent-3,464,049; US-Patent-Appl-SN-691739) Avail: US Patent Office CSCL 13M

A load cell protection device is described which incorporates a spring-loaded, break-away mechanism for axially directed compression or tension forces. The load cell is slidably enclosed within an inner cylindrical housing and spring-biased to one end. The inner housing is slidably enclosed within an outer housing and spring-biased in the opposite direction. The device includes a filter for adapting to operation in corrosive atmospheres. Official Gazette of the U.S. Patent Office

N71-15875# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

FLUTTER OF A RECTANGULAR PLATE WITH REINFORCING RIGID RIBS

N. P. Fleyshman et al 4 Sep. 1970 13 p refs Transl. into ENGLISH from Soprotivlenie Mater. Teor. Sooruzhenii (Kiev), no. 9, 1969 p 43–49

(AD-714778; FTD-HT-23-472-70) Avail: NTIS CSCL 20/4

Investigation of an isotropic rectangular plate which is hinged at two opposing edges while the other two edges are freely supported and reinforced by rigid ribs. The plate is placed in gas flow over the top surface parallel to the hinged edges; it is loaded by constant forces in the plane. The stability of the shell is examined, along with the inverse problem of the relationship between the critical flow rate and the torsional rigidity of the reinforcing ribs for different ratios of the sides. Author (GRA)

N71-15886# California Univ., Los Angeles. Dept. of Materials.

RECENT DEVELOPMENTS IN MACROSCOPIC AND MICROSCOPIC FRACTURE MECHANICS

Alan S. Tetelman Sep. 1970 50 p refs

(Contract DAHC04-69-C-0008)

(AD-714693; TR-2; AROD-8016-2-MC) Avail: NTIS CSCL 20/11

The report presents a brief state-of-the-art review of the science and application of Fracture Mechanics Technology as of Spring 1970. Part 1 contains a brief introduction to fracture mechanics and fracture toughness. Part 2 illustrates how various fracture toughness data correlate with each other. In Part 3 relations between macroscopic and microscopic aspects of fracture in low alloy steels are presented. In Part 4, the fracture behavior of high strength materials is treated, while Part 5 deals with some aspects of safe-life prediction in alloys. Author (GRA)

N71-15889# San Fernando Valley State Coll., Northridge, Calif. School of Engineering.

VIBRATORY SURFACE LOADINGS ON A VISCOELASTIC HALF-SPACE

T. M. Lee Sep. 1970 37 p

(Contract DAAG23-68-C-0018)

(AD-714643; CRREL-RR-286) Avail: NTIS CSCL 13/13

Wave propagation generated by vibratory load on a homogeneous, isotropic, linear viscoelastic half-space is studied. The effect of a single concentrated force and a group of forces applied over a circular area has been examined and solutions of the displacement functions are presented. In the case of the group forces, the three types of force distribution used by Reissner and Sung were employed. At a great distance (far field) from the applied load, surface displacements are reduced to closed form expressions. A field method based on these results is recommended for determining the complex modulus and the damping property of a viscoelastic material. For areas near the source (near field), numerical procedures were employed to evaluate the integral solution. To facilitate the application, two simplified versions are provided for calculating the center displacement under the load. They both provide good approximation to the integral solution and, most important of all, they speed up the computation enormously. Author (GRA)

N71-16039# Advisory Group for Aerospace Research and Development, Paris (France).

AEROELASTIC TEST METHODS: EXPERIMENTAL TECHNIQUES

G. Piazzoli Dec. 1970 38 p refs Transl. into ENGLISH of ONERA, Paris, report Revised

(AGARD-R-573-70) Avail: NTIS CSCL 01C

A survey is given of flight-test methods for investigating the dynamic stability of aircraft, including an appraisal of the capabilities of recently developed practical techniques. It is pointed out that there is a close interdependence between flight tests and other methods, such as ground vibration tests, the determination

of aerodynamic coefficients, either theoretically or experimentally, and the calculation of critical speeds. The choice of flight test method depends on weight, dimensions, electrical power of the installation, nature and frequency of the modes, and means of analysis. Emphasis is laid on the importance of step-by-step exploration of critical areas of the flight range of a prototype. Author

N71-16040# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETERMINATION FOR THE LOWER CRITICAL LOAD OF A CONICAL SHELL IN LONGITUDINAL COMPRESSION
V. V. Mikhailov 4 Sep. 1970 14 p refs Transl. into ENGLISH from Zap. Kharkov Univ., Matematychnyi Viddil (USSR), v. 31, no. 3, 1965 p 94–100
(AD-714760; FTD-HT-23-481-70) Avail: NTIS CSCL 20/11

The lower critical load of a thin, circular, right conic shell under conditions of uniform longitudinal compression is determined. It is assumed that the postcritical condition is reached mainly via geometrical bending. In view of this, the surface which is isometric to the undeformed middle surface is studied. The isometric surface consists of 2 n cylindrical surfaces, the generatrices of which are perpendicular to n planes of symmetry; their number is equal to the number of surfaces originating at the moment of stability loss. For one cylindrical part the energy of deformation is also calculated. The effect of conicity on the lower critical load is investigated. Author (GRA)

N71-16103* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FLEXIBLE RING SLOSH DAMPING BAFFLE Patent
David G. Stephens and George W. Brooks, inventors (to NASA) Issued 28 Apr. 1970 (Filed 3 Jun. 1968) 7 p Cl. 137-582; Int. Cl. E03b11/00 Continuation-in-part of US Patent Appl. SN-532526, Filed 25 Feb. 1966
(NASA-Case-LAR-10317-1; US-Patent-3,508,578; US-Patent-Appl-SN-739927) Avail: US Patent Office CSCL 13G

A device for reducing sloshing of liquid in spacecraft fuel tanks is discussed. The carrying and positioning structure is located in the fuel tank and is designed to be effective at all levels of the liquid. A baffle is attached to the positioning device and can move relatively to it under the influence of the moving liquid. This motion increases mixing action of the fluid and results in decreased sloshing. Official Gazette of the U.S. Patent Office

N71-16106* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
BUOYANT ANTI-SLOSH SYSTEM Patent
David A. Evensen and John P. Raney, inventors (to NASA) Issued 13 May 1969 (Filed 24 Feb. 1967) 5 p Cl. 137-582; Int. Cl. B64g9/00; Int. Cl. B65d87/12
(NASA-Case-XLA-04605; US-Patent-3,443,584; US-Patent-Appl-SN-619519) Avail: US Patent Office CSCL 13D

A system for inhibiting liquid propellant sloshing and swirl in the tanks of liquid propellant rockets during flight is described. This buoyant anti-slosh system uses submerged baffles to inhibit liquid sloshing in the container as it is subjected to forces normally inducing liquid movement relative to the container. Official Gazette of the U.S. Patent Office

N71-16113# Watervliet Arsenal, N.Y.
ELASTIC-PLASTIC ANALYSIS OF ANISOTROPIC ANNULAR PLATES UNDER INTERNAL PRESSURE
Peter C. T. Chen Aug. 1970 43 p refs
(AD-714370; WVT-7028) Avail: NTIS CSCL 20/11

The report contains an elastic-plastic analysis of anisotropic annular disks subjected to internal pressure of sufficient magnitude to cause plastic deformation. The material is homogeneous but texture hardened in such a way that it is transversely isotropic about the thickness direction in both elastic and plastic regions. In the plastic region, Hills yield criterion is adopted, work-hardening effect is neglected and both deformation and flow theories have been considered. Expressions for the stress and strain distributions are obtained, and the results are shown graphically. The effects of anisotropy are discussed and the comparisons of strain solutions by two types of theories are given. Author (GRA)

N71-16114# Naval Intelligence Command, Alexandria, Va. Translation Div.
SOME PROBLEMS OF STRENGTH IN HYDROFOILS [NEKOTORYE VOPROSY PROCHNOSTI PRODVODNYKH KRYLEV]
M. I. Gurevich et al 3 Nov. 1970 13 p refs Transl. into ENGLISH from Sudostroenie (Leningrad), no. 11 p 12–16
(AD-714436; NIC-TRANS-3133) Avail: NTIS CSCL 13/10

The strength of hydrofoil systems is determined by the fatigue characteristics of welded joints. Static design stresses in designing hydrofoil systems can be increased for ductile materials where $t/h > 0.1$-0.15 due to the increase in the yield point on bending. Ductile steels of average strength having good welded joint fatigue characteristics should be considered the optimal material for hydrofoil systems. The repairability of steel (even that recommending itself most highly in operation) is limited, and according to the first tests on testpieces, does not exceed 15%. Author (GRA)

N71-16332# Northwestern Univ., Evanston, Ill. Dept. of Mechanical Engineering and Astronautical Sciences.
THERMOELASTIC INSTABILITY OF FRICTIONAL CONTACTS
T. A. Dow and R. A. Burton 25 Sep. 1970 45 p
(Contract N00014-67-A-0356-0013)
(AD-714025) Avail: NTIS CSCL 20/11

This is a study of the stability of frictional contact of elastic solids. To be specific, the problem is to determine when surface pressure or temperature distributions will be damped, or when they will be amplified by the thermal, frictional and elastic interactions of the surfaces. This effort will shed light on the behavior of numerous lubricated and unlubricated sliding systems such as seals, bearings, and piston rings. It should lead to design criteria in terms of materials and operating parameters. The present report is concerned with two phases of the study: (1) a discrete model of surface contact, and (2) a continuous thin-blade model of surface contact. The first sheds light on the processes at work, and analysis of it leads to a thermal vibration equation with a damping coefficient which may be either negative or positive depending upon the specific operating conditions. The second model provides a more complete treatment of the thermoelastic interactions at work in continuous bodies. The work reported carries the analysis up through the derivation of a pair of algebraic equations involving the materials and operating parameters of the system. Because of the complex relationships involved, further work will be required to determine all of their implications. Author (GRA)

N71-16402# Physics International Co., San Leandro, Calif.
MELT-DOMINATED IMPULSE EXPERIMENTS AND CALCULATIONS Final Report, 23 Jan. 1969–22 Apr. 1970
J. Resugh, A. Lutze, and G. Yonas Sep. 1970 135 p refs
(Contract DASA01-69-C-0085)
(AD-714538; PIFR-144; DASA-2475) Avail: NTIS CSCL 20/11

A combined experimental and analytical study of impulse generation in aluminum has been carried out using intense electron beams as the source of high energy density loading. Both analytical models and hydrodynamic codes were used in the modeling of the observed material response. In addition this report presents a detailed survey of current calculational techniques and an extensive

discussion of the experimental methods required for this work. For the electron beam fluence range employed here, giving peak doses less than 2000 cal/g, a model of liquid spall was found to represent the data well. This model was simplified to an analytical expression which depends exponentially on deposition time and is suitable for predicting melt-dominated impulse in a wide range of materials. In addition, hydrodynamic code calculations have been carried out and comparisons are made with measured transmitted stress histories and liquid ejecta velocities. Author (GRA)

N71-16426# Naval Ship Research and Development Center, Washington, D.C.

THE INFLUENCE OF ADDED MASS ON THE NATURAL VIBRATIONS AND IMPULSE RESPONSE OF LONG, THIN CYLINDRICAL SHELLS

E. W. Palmer Oct. 1970 78 p refs

(AD-714483; NSRDC-3395) Avail: NTIS CSCL 20/11

The plane strain solution is obtained for the natural vibrations and impulse response of a thin circular cylinder containing an added line mass. The solution for a uniform cylinder is derived by taking the added mass to be zero. Numerical calculations of the frequencies and mode shapes for several of the lower modes are presented in graphical form for various values of the added mass. The general impulse response solution for arbitrary initial conditions is obtained by normal mode theory. For both the natural vibrations and impulse response, the theory is found to be in reasonable agreement with available experimental results. In a particular mode, four distinct solution states are found to exist: a symmetrical and anti-symmetrical branch for each class of vibration, flexural and extensional. Noteworthy features revealed by this investigation are the difference in frequency and mode shape of each solution state and the presence of coupling between the flexural and extensional classes, particularly noticeable in the extensional class mode shapes. In comparing impulse response solutions for velocity with and without the added mass, the major influence of the added mass is found to be an increased participation of the flexural class modes, including the rigid body translation, and decreased participation of the extensional class oscillatory modes. Author (GRA)

N71-16427# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.

THE EFFECT OF STRESS CONCENTRATION ON THE LOW-CYCLE FATIGUE OF THREE LOW-STRENGTH STRUCTURAL STEELS AT ROOM TEMPERATURE AND 550 DEG F

E. Krempl Mar. 1970 42 p refs

(Contract AT(04-3)-189

(GEAP-10170) Avail: NTIS

The results of a 4-year testing program on the notched high-strain fatigue behavior of three low-strength structural steels are summarized. The parameters studied were: type of loading, push-pull and bending; influence of mean stress, completely reversed and zero-to-tension loading; state-of-stress, flat plates and grooved cylinders; degree of stress concentration, and temperature, room temperature and 550 F. Notch-root strains were measured and fatigue strength reduction factors are derived. A reasonably conservative life calculation procedure for low-cycle fatigue crack initiation in the presence of stress concentration is proposed and recommended for consideration in design. Author

N71-16428* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

VIBRATING STRUCTURE DISPLACEMENT MEASURING INSTRUMENT Patent

Bruce Flegge, inventor (to NASA) Issued 31 Mar. 1970 (Filed 26 Sep. 1968) 6 p Cl. 73-71.4; Int. Cl. G01r9/04

(NASA-Case-XLA-03135; US-Patent-3,503,251; US-Patent-Appl-SN-582171) Avail: US Patent Office CSCL 13M

A noncontacting transducer is described which is coupled to a servo motor for moving it up or down over a vibrating structure as the transducer is moved along the structure to measure vibration deflection. The initial height of the transducer above the structure is set by manually adjusting an offset voltage which is added to a voltage generated by the transducer to produce a zero voltage at the input of the servo motor. Any change in height of the transducer will result in an error voltage at the input of the servo motor which will cause it to reposition the transducer to its initial height. The output of the transducer is indicative of the vibration of the structure. Official Gazette of U.S. Patent Office

N71-16455# Lehigh Univ., Bethlehem, Pa. Fritz Engineering Lab.

SHEAR IN BEAM-TO-COLUMN CONNECTIONS

David J. Fielding and Joseph S. Huang Sep. 1970 73 p

(Contract N00024-69-C-5381)

(AD-714177; FEL-333.9) Avail: NTIS CSCL 13/5

The condition of high shear stress in rigid frame connections and the effect of high axial force are investigated. A yield condition is derived and verified by a test. After yielding in the test specimen, stable joint deformation was observed and the connection carried 2.75 times what is considered to be the maximum strength in shear. The current AISC design formula is shown to be conservative. Author (GRA)

N71-16456# Lehigh Univ., Bethlehem, Pa. Fritz Engineering Lab.

SPACE FRAMES WITH BIAXIAL LOADING IN COLUMNS: ANALYSES OF BIAXIALLY LOADED COLUMNS

Sakda Santathadaporn and Wai F. Chen Sep. 1970 122 p refs Sponsored in part by Welding Res. Council and Am. Iron and Steel Inst.

(Contract N00014-69-C-5381)

(AD-714176; Rept-331.12) Avail: NTIS CSCL 13/13

The report presents three different types of analyses of biaxially loaded columns: (1) Limit analysis of cross-sections by applying limit theorems to obtain interaction equations (Chapter 2). Both upper and lower bound solutions are presented in order to compare the results; (2) Elastic-plastic analysis of cross-sections by utilizing the tangent stiffness method (Chapter 3); and (3) Stability analysis of biaxially loaded columns by using the tangent stiffness method (Chapter 4). Author (GRA)

N71-16458# Brown Univ., Providence, R.I. Div. of Applied Mathematics.

NONLINEAR BUCKLING OF A SLENDER COLUMN

Frederic Bisshopp Sep. 1970 9 p refs

(Contract Nonr-562(42))

(AD-713997; TR-13) Avail: NTIS CSCL 20/11

A nonlinear, slightly damped model of Euler buckling is discussed. It is shown rigorously that the static criterion (minimum potential energy) for determination of the buckled state is also the dynamic criterion. Author (GRA)

N71-16526# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.

BUCKLING OF CLAMPED OVAL CYLINDRICAL SHELLS UNDER AXIAL LOADS

George Feinstein, Y. N. Chen, and Joseph Kempner Jul. 1970 72 p refs

(Contract F44620-69-C-0072)

(AD-714579; PIBAL-70-34; AFOSR-70-2319TR) Avail: NTIS CSCL 13/13

The effect of clamped boundary conditions on the elastic buckling of finite, oval cylindrical shells under axial compression is investigated. In the development of the problem, a rather accurate representation of the prebuckling state is employed. The rigorous boundary conditions are enforced on both the prebuckling and buckling solutions. The stability equations are solved by the Fourier method in conjunction with the use of a higher order difference technique. Noticeable deviations between the results of the present analysis and those established for infinitely long shells were observed, particularly for moderate-to-large out-of-roundness. Author (GRA)

N71-16536# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.

EXPERIMENTAL INVESTIGATION OF THE BUCKLING OF CLAMPED OVAL CYLINDRICAL SHELLS UNDER AXIAL COMPRESSION

George Feinstein, Burton Erickson, and Joseph Kempner Jul. 1970 37 p refs

(Contract F44620-69-C-0072)

(AD-714578; PIBAL-70-27; AFOSR-70-1991TR) Avail: NTIS CSCL 13/13

Elastic buckling under axial compression of finite, oval cylindrical shells with clamped boundaries was investigated experimentally. The determination of the buckling strength was made on a series of oval shells made of Mylar A. The test results indicated that the discrepancy between theoretical and experimental initial buckling loads for the ovals is similar to that of the circular cylindrical shells. However, in contrast to the circular case, a collapse load significantly exceeding the initial buckling load is observed in the case of ovals with moderate-to-large eccentricity. Author (GRA)

N71-16537*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

MINIMUM-MASS ISOTROPIC SHELLS OF REVOLUTION SUBJECTED TO UNIFORM PRESSURE AND AXIAL LOAD

W. Jefferson Stroud Washington Feb. 1971 44 p refs

(NASA-TN-D-6121; L-5981) Avail: NTIS CSCL 20K

A method is presented for calculating the shape and thickness distribution of a minimum-mass shell of revolution for given coordinate and slope end conditions and given values of axial load and pressure load. The method uses linear membrane theory to relate the loading and shape to stress resultants and the strain energy of distortion (Von Mises) yield condition to relate the stress resultants to the thickness. The mass can then be expressed as an integral which is a function of shape. The integral is minimized by a Ritz procedure together with mathematical programming methods; that is, the shell shape is written in the form of a series of functions with undetermined coefficients, and the mass is minimized with respect to these coefficients. The shape, thickness distribution, and stress distributions are given for several examples. Author

N71-16568# Notre Dame Univ., Ind. Dept. of Aerospace and Mechanical Engineering.

OPTIMUM DESIGN OF LINEAR ELASTIC BEAMS UNDER DYNAMIC LOADING Final Report, 1 Nov. 1966 - 31 Aug. 1970

Raymond M. Brach 24 Sep. 1970 7 p refs

(Grants DA-ARO(D)-31-124-G875; DA-ARO(D)-31-124-G-1058)

(AD-713966; AROD-6861-4-E) Avail: NTIS CSCL 20/11

The object of the research was to develop optimization techniques to solve problems involving free and forced vibration of beams and rods. In all cases, the cross sectional area distribution is treated as the unknown. For free vibration frequency optimization was studied and design or synthesis of characteristic functions was also covered. For forced vibration problems, minimum response solutions for a limited class of area functions were found. Author (GRA)

N71-16752*# Texas A&M Univ., College Station. Dept. of Aerospace Dept.

SAMMSOR 2: A FINITE ELEMENT PROGRAM TO DETERMINE STIFFNESS AND MASS MATRICES OF SHELLS OF REVOLUTION

Joe R. Tillerson and Walter E. Haisler 15 Oct. 1970 74 p refs

(Grant NGL-44-001-044)

(NASA-CR-114824; TEES-RPT-70-18) Avail: NTIS CSCL 20K

A user's guide for the SAMMSOR 2 computer code is presented. The finite element method of analysis is employed using a curved shell of revolution element to determine structural stiffness and mass matrices. Documentation of the analysis technique is included along with user hints and a discussion of the program limitations. Instructions for preparing the input data are included along with procedures for modifying the code. This program has the capability of internally generating the geometry of a number of important classes of shell configurations (such as shallow caps, cylinders, cones, and hemispheres). Several example problems are presented to aid the user. Author

N71-16836# Bettis Atomic Power Lab., Pittsburgh, Pa.

A METHOD OF ANALYSIS FOR THE CREEP-BUCKLING OF TUBES UNDER EXTERNAL PRESSURE (LWBR DEVELOPMENT PROGRAM)

W. K. Wilson Oct. 1970 58 p ref

(Contract AT(11-1)-GEN-14)

(WAPD-TM-956) Avail: NTIS

A numerical method for the creep-buckling analysis of long circular cylinders which are initially out-of-round and subjected to uniform external pressure is presented. The method eliminates the need for many of the major assumptions previously used and can handle any combination of either strain hardening or time hardening and either the Mises flow rule or the Tresca flow rule. A computer program written to carry out the steps of the numerical method is described. A number of specific cases are studied and the results indicate that the calculated buckling times are highly dependent on the hardening law and the flow rule used. Author (NSA)

N71-16841*# Techtran Corp., Glen Burnie, Md.

NATURE OF THE FAILURE OF A UNIDIRECTIONAL FIBERGLASS-REINFORCED PLASTIC UNDER COMPRESSION [O KHARAKTER RAZRUSHENIIA ODNONAPRAVLENNOGO STEKLOPLASTIKA PRI SZHATII]

A. N. Guz et al Washington NASA Jan. 1971 7 p refs Transl. into ENGLISH from Prikl. Mekhan. (USSR), v. 5, Sep. 1969 p 118-121

(Contract NASw-2037)

(NASA-TT-F-13442) Avail: NTIS CSCL 20K

Analysis of the compression of plastic samples reinforced in a single direction, under the assumption that compression occurs along the fibers is presented. A theory is proposed which satisfactorily describes the failure characteristics of reinforced samples loaded in this way. Author

N71-16842 Virginia Univ., Charlottesville.

PLASTIC BUCKLING OF AXIALLY COMPRESSED THIN SHELLS OF REVOLUTION WITH ARBITRARY MERIDIONAL SHAPE

David Berger Oglesby (Ph.D. Thesis) 1969 160 p

Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 70-4820

The determination of the axisymmetric localized plastic buckling loads for thin structural shells of revolution with arbitrary meridional shape subjected to axial compressive loading is presented. The buckling analysis is treated mathematically as a nonlinear equilibrium boundary value problem. The equilibrium equations are derived using Langhaar's differential geometry approach. Plastic material behavior is introduced through the Tresca yield criterion, a bilinear stress-strain curve (linear isotropic, strain-hardening behavior) and by assuming that the behavior of the uniform shell can be represented by the behavior of a sandwich shell model. The constitutive relations for regular and nonregular progressions of the stress point are provided. The plastic buckling load is determined by a criterion based on the load-deflection behavior of the shell during an incremental loading procedure. Dissert. Abstr.

N71-16846*# National Aeronautics and Space Administration. Langley Research Station, Langley Station, Va.

COMPUTER PROGRAM FOR STATIC AND DYNAMIC AXISYMMETRIC NONLINEAR RESPONSE OF SYMMETRICALLY LOADED ORTHOTROPIC SHELLS OF REVOLUTION

Wendell B. Stephens Washington Dec. 1970 98 p refs
(NASA-TN-D-6158; L-6299) Avail: NTIS CSCL 20K

A computer program has been developed which determines the nonlinear behavior of symmetrically loaded elastic orthotropic shells of revolution. The loading can be due to either mechanical or thermal forces and can be applied statically or dynamically. The analysis is based on Sanders' equations for shells with small strains and moderately small rotations and allows for variable stiffness properties of the shell along the meridian. Spatial derivatives are approximated by finite differences, and integration with respect to time is carried out by the Houbolt method. For static behavior, or dynamic response at each point in time, a Newton-Raphson method is applied for convergence to the nonlinear solution. The boundary conditions are presented in a general form which allows either classical or elastic constraints to be used. The program, which is written in FORTRAN 4 language, is described in detail and sample calculations are included. Author

N71-16847*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

LAMINATION RESIDUAL STRESSES IN MULTILAYERED FIBER COMPOSITES

Christos C. Chamis Washington Feb. 1971 29 p refs
(NASA-TN-D-6146; E-5848) Avail: NTIS CSCL 11D

Residual stresses arising from the lamination fabrication process are investigated using linear laminate theory. An equation to predict the residual stresses is given. The pertinent variables that influence residual stresses are identified. Several composite systems with various ply layup configurations are examined. Results are presented to illustrate the dependence of residual stresses on the pertinent variables. The residual stresses are very sensitive to constituent material properties, composite stacking sequence and orientation, fiber content, and processing temperature. It is found that ply transverse tensile and in-plane shear residual stresses can reach magnitudes comparable to corresponding ply strengths and cause transply cracks in the composites. Residual stresses can also cause interply delamination. Ways to prevent transply cracking and interply delamination are recommended. Author

N71-16848# Lehigh Univ., Bethlehem, Pa.

DEFORMATION OF RIGID-PLASTIC SPHERICAL SHELLS IN LOW VELOCITY IMPACT

Dean P. Updike 1 Apr. 1970 40 p refs
(Contract N00014-67-A-0370-0003)
(AD-714519; TR-3) Avail: NTIS CSCL 13/10

The behavior of a rigid-perfectly plastic spherical shell loaded under static conditions simulating low velocity impact of the shell against a flat rigid surface is considered. Large axisymmetric deformations of the shell are investigated. At each stage of deformation an approximate limit load and corresponding velocity field are found for an assumed deformed shape of the shell, which later is shown to be very close to the calculated deformed shape. A simple formula relating the total axial force on the shell to the displacement of the shell is derived, and its range of validity is investigated. Finally, the results of some static tests of shells are shown to agree favorably with the theory. Author (GRA)

N71-16849# Lehigh Univ., Bethlehem, Pa. Fritz Engineering Lab.

BEHAVIOR OF STRUCTURAL SUBASSEMBLAGES WITH LATERALLY UNSUPPORTED COLUMNS

Lee C. Lim and Le-Wu Lu Jun. 1970 68 p refs Sponsored in part by the Welding Res. Council and the Am. Iron and Steel Inst.
(Contract N00024-69-C-5381)
(AD-714516; Rept-329.3) Avail: NTIS CSCL 13/13

Results are given for tests on two full-size non-sway structural subassemblages with laterally unsupported columns. All columns were designed with the procedure currently recommended for plastically design structures. The results indicate a substantial post-buckling strength for unbraced columns in a continuous frame system and demonstrate the conservativeness of the current design procedure for this type of column. Author (GRA)

N71-16850*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

AN EXPERIMENTAL AND ANALYTICAL VIBRATION STUDY OF ELLIPTICAL CYLINDRICAL SHELLS

John L. Sewall (Naval Ship and Development Center), William M. Thompson, Jr. (Naval Ship and Development Center), and Christine G. Pusey Washington Feb. 1971 82 p refs
(NASA-TN-D-6069; L-6632) Avail: NTIS CSCL 20K

An experimental and analytical vibration study of free-free isotropic elliptical cylindrical shells of constant mass ranging in cross-sectional eccentricity from zero (circular shell) to 0.918 is reported. Experimental resonant frequencies, nodal patterns, and mode shapes were obtained by use of an air-jet shaker or an electrodynamic shaker with a noncontract inductance probe that could be moved over most of the shell surface. Experimental frequencies were in generally good agreement with analytical frequencies calculated by means of a Rayleigh-Ritz type of analysis featuring multiterm longitudinal and circumferential modal expansions. Frequencies for shells with eccentricity of 0.918 were as much as 40 percent below the corresponding circular-shell frequencies. As eccentricity increased, analytical and experimental mode shapes indicated considerable longitudinal and circumferential modal coupling. Author

N71-16871# Bureau of Reclamation, Denver, Colo. Div. of Design.

MOMENTS AND REACTIONS FOR RECTANGULAR PLATES

W. T. Moody 1970 97 p refs *Its* Eng. Monograph No. 27
Avail: SOD $1.00 CSCL 20K

Tables containing computed data for use in the design of structural components which can be idealized as rectangular plates or slabs are presented. Typical examples are wall and footing panels of counterfort retaining walls. The tables provide a rapid and economical means of analyzing the structures at representative points. The data were computed for five sets of boundary conditions, nine ratios of lateral dimensions, and eleven loadings typical of

those encountered in designing. An example for the application of the data to a typical structure is presented; the basic mathematical considerations and application of the finite difference method to the solution of plate problems are explained. Drawings which present basic relations that aid in the application of the method to other problems are included. Author

N71-16876# Shock and Vibration Information Center (Defense), Washington, D.C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 2, NO. 11, NOVEMBER 1970
Nov. 1970 43 p refs
(AD-714657) Avail: NTIS CSCL 20/11

Contents: Plastic models for structural analysis (Part I); Previews of meetings; Short courses; Abstracts from the current literature; (Analysis and design methods, Excitation, Phenomenology, Experimentation, Components, Systems); Book reviews. GRA

N71-16877# Brown Univ., Providence, R.I. Div. of Engineering.
EFFECTIVE USE OF THE INCREMENTAL STIFFNESS MATRICES IN NONLINEAR GEOMETRIC ANALYSIS
George A. Dupuis, Dieter D. Pfaffinger, and Pedro V. Marcal Sep. 1970 36 p refs Presented at IUTAM Symp. on High Speed Computing of Elastic Struct., Liege, Aug. 1970
(Contract N00014-67-A-0191-0007)
(AD-713967; TR-5) Avail: NTIS CSCL 20/11

A study was made of the use of the incremental stiffness matrices in nonlinear elastic analysis. It was shown that its use in an iterative initial force method leads to convergence at loads below the buckling load. Eigenvalue formulations were then developed for nonlinear and linear buckling analysis. Numerical results were obtained for spherical caps and cylinders with imperfections. These results were in agreement with results in the literature. The shell imperfections were treated directly and were included in the description of the shell geometry. In the case of a cylinder with imperfections it was found that a linear buckling analysis was sufficient to give agreement with the results obtained from the Koiter theory. It was found necessary to include the initial displacement stiffness matrix in all cases investigated in this paper. Author (GRA)

N71-16883*# Texas A&M Univ., College Station. Aerospace Engineering Dept.
DYNASOR 2: A FINITE ELEMENT PROGRAM FOR THE DYNAMIC NONLINEAR ANALYSIS OF SHELLS OF REVOLUTION
Joe R. Tillerson and Walter E. Haisler 15 Oct. 1970 98 p refs Prepared for Sandia Corp.
(Grant NGL-44-001-044)
(NASA-CR-114823; TEES-RPT-70-19) Avail: NTIS CSCL 13M

A user's guide for the DYNASOR II computer code is presented. The finite element method of structural analysis is utilized for the analysis with the Houbolt numerical scheme being employed to solve the equations of motion of the system. Documentation of the analysis techniques is presented along with guidelines for utilizing the code and enumerating the limitations placed upon its use. The procedures for preparing the input data are presented and several example problems demonstrate the required input data for specific loadings. The extended appendix provides additional insight into the inner workings of the code. Using the DYNASOR II code, the nonlinear dynamic response of shells of revolution can be obtained in relatively short periods of computer time for a large number of important shell problems. Author

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N71-15851# Los Alamos Scientific Lab., N.Mex.
METHOD FOR THE NUMERICAL DETERMINATION OF THERMAL CONDUCTIVITY
B. L. Buzbee and F. W. Dorr Jul. 1970 7 p refs
(Contract W-7405-ENG-36)
(LA-4485) Avail: NTIS

A computational procedure is described for determining the thermal conductivity of a material from experimentally determined transient cooling data. Author (NSA)

N71-15963# Rocketdyne, Canoga Park, Calif. Mathematics and Statistics Research Div.
FREE BOUNDARY VALUE PROBLEMS OF HEAT FLOW AROUND AERODYNAMIC BODIES AND CONTROL THEORY Final Report
B. Sherman and R. Van Wyk 17 Sep. 1970 23 p refs
(Contract AF 49(638)-1679)
(AD-714621; R-8363; AFOSR-70-2533TR) Avail: NTIS CSCL 20/13

Research results concerned primarily with qualitative aspects of free boundary problems are reviewed. These results are in the following areas: (1) existence and uniqueness for the one-phase nonhomogeneous Stefan problem, (2) continuous dependence on the data for the same problem, (3) existence of solution and behavior of the free boundary for the general one-phase Stefan problem, (4) behavior of the free boundary when it coincides initially with the fixed face, (5) convergence when the latent heat goes to zero, and (6) existence and uniqueness for free boundary problems for the heat equation in which Cauchy data is prescribed on the free boundary. Author (GRA)

N71-16043# Ballistic Research Labs., Aberdeen Proving Ground, Md.
HYDROCARBON COMBUSTION AND PHYSICAL PROPERTIES
Dudley J. Mc Cracken Sep. 1970 373 p refs
(AD-714674; BRL-1498) Avail: NTIS CSCL 21/2

Many tabulations of hydrocarbon combustion properties are found in the literature. Unfortunately, most of these report what the author believes to be the best value for each property, and do not include all combustion properties. This report presents a compilation of combustion and physical properties which can be used in a variety of combustion problems. Referenced values are included for flash point, flammability limits, autoignition temperature, maximum flame velocity, minimum ignition energy, and quenching distance. The physical properties include molecular weight, carbon-hydrogen ratio, vapor density, heats of combustion and vaporization, liquid density, refractive index, surface tension, viscosity and vapor pressure data. Author (GRA)

N71-16104* National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
BOILER FOR GENERATING HIGH QUALITY VAPOR Patent
Vernon H. Gray and Allan W. Joslyn, inventors (to NASA) Issued 28 Apr. 1970 (Filed 6 Sep. 1967) 8 p Cl. 60-108; Int. Cl.

F01d1/00; Int. Cl. F22b5/00
(NASA-Case-XLE-00785; US-Patent-3,508,402;
US-Patent-Appl-SN-666554) Avail: US Patent Office CSCL 13A

A boiler for supplying high quality vapor to a turbine motor is described. Application of high angular velocities to the liquid forms an annulus in the heated, rotating drum and produces a sharp interface between the liquid phase and the vapor phase.
Official Gazette of the U.S. Patent Office

N71-16277* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
METHOD OF IMPROVING HEAT TRANSFER CHARACTERISTICS IN A NUCLEATE BOILING PROCESS Patent
Lou D. Allen, inventor (to NASA) Issued 24 Mar. 1970 (Filed 23 Dec. 1965) 6 p Cl. 165-133; Int. Cl. F28f13/18, 19/02
(NASA-Case-XMS-04268; US-Patent-3,502,141;
US-Patent-Appl-SN-516160) Avail: US Patent Office CSCL 20M

A method is described for reducing the cooldown time and enhancing the steady heat transfer characteristics of a circulating cryogenic cooling system. It consists of coating the surfaces exposed to the cryogenic cooling liquid with high molecular-weight, plastic-resin material having a thickness in the range of .001 to .004 inch and roughening the exposed surface of the plastic-resin material to establish a random pattern of pits and indentations. A cryopanel processed by this method is described.
Official Gazette of the U.S. Patent Office

N71-16278* Vapor Corp., Chicago, Ill. Vap-Air Div.
METHOD AND APPARATUS FOR CONTROLLABLY HEATING FLUID Patent
Thomas E. Carlisle and Edward J. Flannery, inventors (to NASA) Issued 23 Jun. 1970 (Filed 9 Feb. 1966) 6 p Cl. 219-364; Int. Cl. H05b1/02 Sponsored by NASA Substitute for abandoned US Patent Appl. SN-309781, filed 18 Sep. 1963
(NASA-Case-XMF-04237; US-Patent-3,517,162;
US-Patent-Appl-SN-539237) Avail: US Patent Office CSCL 20M

A method is described for achieving high efficiency and power economy in a fluid circulating heater. This is accomplished by placing the heat control unit in a conduit, upstream from the heat generator, thus using the heat generated in the control system for preheating the fluid prior to reaching the heat generator. The circuitry includes under-temperature, over-temperature controls, and an auxilliary heater.
Official Gazette of the U.S. Patent Office

N71-16356* Rocketdyne, Canoga Park, Calif.
THERMOBULB MOUNT Patent
Robert B. Schaus, inventor (to NASA) Issued 1 Sep. 1970 (Filed 21 May 1968) 4 p Cl. 73-343; Int. Cl. G01k1/08,1/14 Sponsored by NASA
(NASA-Case-NPO-10158; US-Patent-3,526,134;
US-Patent-Appl-SN-730702) Avail: US Patent Office CSCL 13A

A fixture is described for holding a temperature sensing element in a pipeline so as to prevent damage to the element which might otherwise be caused by fluid flow through the pipeline. The fixture comprises an installation boss with a hole through which the sensing element extends, and a recess formed on the inside of the pipeline opposite the boss for supporting the outboard end of the sensing element.
Official Gazette of the U.S. Patent Office

N71-16357* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MOUNT FOR THERMAL CONTROL SYSTEM Patent
William J. Kearns, inventor (to NASA) Issued 1 Sep. 1970 (Filed 12 Sep. 1968) 6 p Cl. 236-1; Int. Cl. H05b1/00 Sponsored by NASA
(NASA-Case-NPO-10138; US-Patent-3,526,359;
US-Patent-Appl-SN-759457) Avail: US Patent Office CSCL 13A

An apparatus is described for controlling the temperature of a component, comprising a mounting block of high thermal conductivity clamped to the component, a heating element mounted on one side of the block to heat it, and a temperature sensing element mounted on the other side of the block to measure the mounting block temperature.
Official Gazette of the U.S. Patent Office

N71-16414# Oak Ridge National Lab., Tenn.
HEAT TRANSFER AND PRESSURE VARIATION IN THE CONDENSATION OF FLOWING STEAM IN INCLINED TUBES [WAERMEUEBERGANG UND DRUCKAENDERUNG BEI DER KONDENSATION VON STROEMENDEM DAMPF IN GENEIGTEN ROHREN]
Franz J. Schulenberg (Ph.D. Thesis) [1970] 135 p refs Transl. into ENGLISH of Stuttgart Univ. Thesis
(K-Trans-60) Avail: NTIS

In process technology and the power industry, low-pressure vapors today are frequently condensed in long vertical or inclined tubes. Among other things, this design is used increasingly in air-cooled condensors. Heat transfer and pressure variation processes during concansation of high-velocity low-pressure water vapor flowing in vertical and inclined tubes were studied experimentally and theoretically.
Author

N71-16429*# Hayes International Corp., Birmingham, Ala.
APPLICATION OF MODERATE RESOLUTION BAND MODELS TO THE PREDICTION OF HEAT TRANSFER FROM ROCKET EXHAUST PLUMES
J. E. Reardon and G. B. McKay Apr. 1970 66 p refs
(Contract NAS8-21162)
(NASA-CR-102998; ER-1677) Avail: NTIS CSCL 20M

The application of band model representations of gaseous radiation to the prediction of heat transfer from rocket exhaust plumes was investigated. The study included development of a radiation computer program, evaluation of the effect of scale on gaseous radiations, and a radiometer measurement of a J-2 engine under simulated altitude conditions.
Author

N71-16461# Picatinny Arsenal, Dover, N.J.
DIFFERENTIAL THERMAL ANALYSIS OF PRIMARY EXPLOSIVES: A MODIFIED TECHNIQUE
R. J. Graybush, F. G. May, and A. C. Forsyth Sep. 1970 22 p refs
(AD-714205; PA-TR-4042) Avail: NTIS CSCL 7/4

The usefulness of DTA (differential thermal analysis) in the study of primary explosives has been diminished by the tendency of samples to detonate in the course of the analysis. The report describes modifications made to the remote cell used in conjunction with a du Pont 900 DTA, and which minimize the probability of detonation. Using lead azide to evaluate the technique, it is shown that complete curves of the exothermic decompositon PbN6 to Pb + 3N2 are obtained reproducibly. The endotherm in the curve corresponding to the fusion of the lead product serves as confirmation of the reaction, and it is employed as an internal temperature calibration. Illustrations are given to show extensions of the system to other initiating explosives of military interest, i.e., lead styphnate, mercury fulminate, and potassium dinitro benzfuroxan (KDNBF).
Author (GRA)

N71-16682*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPLIED MECHANICS
In its Space Programs Sum. No. 37-65, Vol. 3, Aug. - Sep. 1970 31 Oct. 1970 p 136 - 141 refs (See N71-16671 06-30)

Copyright. Avail: NTIS CSCL 20M

Applied mechanics is discussed with respect to thermal modeling of spacecraft with imperfect models and thermal radiative characteristics of solar arrays determined by calorimetric techniques. The thermal models and techniques are designed for the Mariner Venus-Mercury 1973 flyby missions. R.B.

N71-16872*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

ABLATIVE PERFORMANCE OF VARIOUS LOW-DENSITY ELASTOMERIC COMPOSITES

William E. Howell Washington Feb. 1971 27 p refs

(NASA-TN-D-6130; L-6635) Avail: NTIS CSCL 20M

Results are presented of an experimental investigation of the performance of low-density (160 to 320 kg/cu m) silicone-phenolic and commercial ablative composites. Tests were conducted in air and in a mixture of 72 percent nitrogen and 28 percent carbon dioxide by mass. The ablative performance of the silicone-phenolic composites increased significantly as the density decreased. Also, the performance of these composites was found to be influenced by stream composition when tested at a cold-wall heating rate of about 0.2 MW/sq m, but the stream composition had little effect at a heating rate of about 0.6 MW/sq m. The addition of nylon to the silicone-phenolic material improved the ablative performance. Three commercial composites were tested and their ablative performances were compared with those of the silicone-phenolic composites of comparable densities. When the heat of degradation was considered, a commercial composite that incorporated a high volume percentage of ground cork filler appeared to be superior to the other composites. However, a comparison made on the basis of a more significant parameter, the ablative effectiveness, showed little difference in the ablative performance of the various composites. Author

N71-16875# Massachusetts Inst. of Technology, Cambridge. Heat Transfer Lab.

REFRIGERANT FORCED-CONVECTION CONDENSATION INSIDE HORIZONTAL TUBES

Soonhoon Bae, John S. Maulbetsch, and Warren M. Rohsenow 1 Dec. 1970 56 p refs

(DSR-72591-71) Avail: NTIS

High vapor velocity condensation inside a tube was studied theoretically. The heat transfer coefficients were calculated by the momentum and heat transfer analogy. The Von Karman universal velocity distribution was applied to the condensate flow. Pressure drop was calculated by the Lockhart–Martinelli method and the Zivi void fraction equation. Experimental data were obtained for the mass velocities from 150,000 to 555,000 lb-momentum/ft-squared hr for R-12 and R-22 condensing in a 0.493 in. I.D. 18 ft long test section. The measured heat transfer coefficients agreed with the prediction within 10% except a few points in the very low quality region. Author

N71-16878 California Univ., Davis.

THE EFFECT OF GASEOUS FILM COOLING ON THE RECOVERY TEMPERATURE DISTRIBUTION IN ROCKET NOZZLES

Joseph James Williams (Ph.D. Thesis) 1969 132 p

Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 70-3163

Film cooling effectiveness data were obtained from a series of hot gas tests with three, geometrically different, channels. The first was a constant diameter duct. The other two were rocket nozzles, one of which converged very gradually and the second rapidly to throat diameters of one inch. These tests were conducted using hydrogen-air combustion as the primary source of hot gas and nitrogen as the injectant. The mixture ratio was selected to provide a nominal chamber pressure and stagnation temperature of 200 psig and 1000 F, respectively. Finally, the data indicate that, with film cooling, improved effectiveness in the throat region of a rocket nozzle is obtained with more rapidly converging configurations. For the same ratio of injectant to free stream mass flows (5 percent) and the same injection area ratio (16), the cooling effectiveness at the throat was increased from 20 percent to 41 percent when the throat approach radius of curvature was decreased from 4 inches to 1 inch. Dissert. Abstr.

N71-16879# Atomics International, Canoga Park, Calif.

EFFECTS OF VELOCITY, OXIDE LEVEL, AND FLOW TRANSIENTS ON BOILING INITIATION IN SODIUM

D. Logan, C. J. Baroczy, J. A. Landoni, and H. A. Morewitz 28 Sep. 1970 72 p refs

(Contract AT(04-3)-701)

(AI-AEC-12939) Avail: NTIS

Data are presented for incipient boiling superheat for sodium flowing upward in a 15- and 30-in.-long vertical annulus formed by a heated stainless-steel tube of 1/4-in. dia located inside a 1/2-in-diam tube. The data covered the following ranges: saturation pressure, 4.2 to 6.7 psia; liquid velocity, 1.6 to 9.4 lb/sec; heat flux, 0.11 to 0.77 × 1,000,000 Btu/hr-sq ft; inlet subcooling, 100 to 400 F; observed bulk superheat, -29 to + 132 F. Comparisons of the observed superheats were made with the Laplace formula and the dynamic-superheat model. Specific directions for thermal effects were indicated by the all-liquid heat balance. Forced-convection boiling-inception wall superheats were well below predictions based on models and did not exceed 50 F at velocities greater than 5 ft/sec. Author (NSA)

N71-16882# Addis Translations International, Woodside, Calif.

CRITICAL INITIATION PRESSURES OF EXPLOSIVES

A. N. Afanasenkov et al Sep. 1970 49 p refs Transl. into ENGLISH from Sb. Vzryvnoe Delo, Nauch.-Tekh. Gorn. Obshchest. (USSR), no. 68/25, 1970 p 88–92 Prepared for Calif. Univ., Lawrence Radiation Lab.

(UCRL-TRANS-10490) Avail: NTIS

The critical initiation pressure of explosives by a shock wave is investigated as a basis for designing containers for the transportation and carriage of explosives, for the transmission of detonation from one explosive charge to another, and for making casings for such charges. The magnitude of the critical initiation pressure depends on a number of factors, included among them are the density and geometry of the charge and its linear combustion velocity. In the case of homogeneous explosives (liquids and single crystals) the magnitude of the pressure is determined mainly by the dynamic compressibility of the explosive and the latter's kinetic properties. The concept of dynamic compressibility and the shock adiabatic are regarded as equivalent. E.M.C.

N71-16885*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THRUSTER EXHAUST EFFECTS UPON SPACECRAFT

Warren C. Lyon (Hittman Associates, Inc., Columbia, Md.) Oct. 1970 273 p refs Prepared by Hittman Associates, Inc., Columbia, Md.

(Contracts NAS5-9479; NAS5-11826)

(NASA-TM-X-65427; X-460-70-401) Avail: NTIS CSCL 21B

A study was conducted of the effect of thruster exhaust effluent upon spacecraft. Small thrusters (micropounds to several millipounds) utilizing cesium, Teflon, ammonia, and hydrazine as fuel have been considered. A brief summary of mercury thruster effects reported by others is included. Few problems were found

with ammonia and hydrazine. The major potential interactions are the effect upon the environment density, and exhaust from these thrusters can coat radiators which operate at 70 K. Cesium and mercury will coat surfaces, particularly radiators which operate in the vicinity of 100 K. Charge exchange effects are quite important in predicting some of these effects. Contaminants in the exhaust beam can be particularly important because these components do not evaporate once condensed upon surfaces. The Teflon thruster can coat any surface placed in the vicinity of the exhaust beam. This coating will be quite inert, and would require high temperatures for its removal. It would consist, in part, of the basic Teflon polymer. A preliminary study of potential cesium thruster–Polaris star tracker interactions indicates that reflected sunlight will be a problem. Author

N71-16886# Dynamic Science, Irvine, Calif.
COMBUSTION CHEMISTRY AND MIXING IN SUPERSONIC FLOW Final Report
Stuart Hersh and Melvin Gerstein Sep. 1970 69 p refs
(Contract F44620-68-C-0069)
(AD-714109; DS-TR-A-70-103; AFOSR-70-1873TR) Avail: NTIS CSCL 21/2

Analytical and experimental investigations of the ignition and combustion of hydrogen-oxygen-argon mixtures are presented. A one-dimensional kinetics program with generalized chemistry and provisions for mass addition, momentum addition, heat loss, mixing, shock waves, and a rate screening option has been developed and used to analyze the effect of free radical additives on the ignition delay time in hydrogen-oxygen mixtures. The computer program has also been used to reduce shock tube measurements of hydrogen-oxygen ignition delay and OH doublet Sigma-doublet Pi emission. The experimental results indicate that the reaction O+H(+M) yielding OH^*(+M) is responsible for producing OH(doublet Sigma) during the induction period; however, this mechanism, when input into the computer program, was not sufficient to qualitatively reproduce OH emission intensity profiles obtained experimentally. Work aimed at determining the mechanism for OH emission throughout the reaction zone is continuing. Author (GRA)

N71-16887*# Catholic Univ. of America, Washington, D.C. Dept. of Space Science and Applied Physics.
MATHEMATICAL MODELING OF CRYOGENIC HEAT PIPES
S. W. Chi Sep. 1970 123 p refs
(Grant NGR-09-005-071)
(NASA-CR-116175) Avail: NTIS CSCL 20M

A qualitative investigation of the performance of heat pipes using different working fluids was made, and the significance of liquid property variations on the performance of cryogenic heat pipes is described. A theory is developed for the cryogenic heat pipe which takes into account the liquid property variations. Predictions by the present theory compare favorably with Haskin's experiments. A computer program in Fortran IV language was written for the theory. Physical properties of cryogenic fluids, which are required as program input data are collected. For convenience of the user of the theory, a complete listing of the program with user's instructions and collected properties of cryogens are appended to the report. A chart is presented of the complete performance of cryogenic heat pipes. A procedure for computer aided design of cryogenic heat pipe is also described. The procedure consists of the following steps: (1) choice of fluid and wick structure, (2) determination of wick dimensions, and (3) generation of performance chart for the designed heat pipe. Author

N71-16890# Scientific Translation Service, Ann Arbor, Mich.
HEAT TRANSFER AND PRESSURE DROP DURING CONDENSATION OF REFRIGERANT VAPORS IN AIR-COOLED CONDENSERS
F. Schulenberg [1970] 21 p refs Transl. into ENGLISH from Kaeltetechnik, Klim. (Karlsruhe), v. 22, no. 3, 1970 p 78–81
Prepared for Oak Ridge Natl. Lab.
(K-TRANS-57) Avail: NTIS

Based on tests performed with condensing refrigerants and steam, empirical formulas are given for the heat transfer and pressure drop during the condensation of fast-flowing vapors with a strong decrease in velocity inside long vertical or inclined tubes. Also instructions are given for calculating roughly the heat exchange surface of parallel tube rows in an air-cooled condenser not utilized for condensation. Author

N71-16899# Lockheed Missiles and Space Co., Palo Alto, Calif.
ANALYSIS OF THE MAIN SYSTEMS OF RADIATION HEAT CELLS WITH A NON-DISTRIBUTED DETECTION AREA
B. P. Kozyrev [1970] 5 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Leningrad), no. 8, 1970 p 107–111
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Equations for radiation heat cells, which are the foundation of constructing new actinometric and radiometric devices are found. A formula is obtained for the signal generated in the radiation heat cell loop under the effect of irradiation on its active area, and the expression for the thermal emf generated in the loop of an evacuated black-white pyranometer is given. Formulas for the compensated radiation heat cell are also derived. It is concluded that a radiation heat cell with cold junctions on the housing is always more responsive than a radiation heat cell with cold junctions on the surface. F.O.S.

N71-16900# Lockheed Missiles and Space Co., Palo Alto, Calif.
THERMAL RADIATION OF SMALL SPHERES
F. Kh. Baibulatov et al [1970] 4 p refs Transl. into ENGLISH from Zh. Prikl. Spektrosk. (Belorussia SSR), v. 12, no. 6, 1970 p 1140–1142
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The spectral radiation intensity of spherical particles for constant temperatures and several values of particle radius are numerically computed. Selected for the analysis was tin and lead, for which there exist the most reliable optical constant data obtained experimentally at room temperature in the 1 to 12 micron wavelength range. Author

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N71-16331# Maryland Univ., College Park. Center of Materials Research.
MATERIALS SCIENCES PROGRAM Final Annual Report, 1 Jul. 1969–30 Jun. 1970
(Contract ARPA SD-101)
(AD-713990) Avail: NTIS CSCL 7/4

Work accomplished in the following general areas is summarized: Laser science and technology; Synthesis and structure of materials; High pressure studies and effects; Studies of superconducting materials; Mechanical properties of metals and alloys; Optical and spectroscopic properties of materials; Magnetic and electromagnetic properties of materials; and Chemical and thermodynamic properties of materials. GRA

N71-16386# RAND Corp., Santa Monica, Calif.
NETWORK EVALUATION OF COMPLEX TRANSPORTATION SYSTEMS
Keith V. Smith, Charles T. Phillips, and Ralph J. Lewis Oct. 1970 15 p refs Presented at the 11th Am. Meeting of the Inst. of Management Sci., Los Angeles, 19 Oct. 1970
(AD-714331; P-4470) Avail: NTIS CSCL 15/5

Transportation is recognized as a critical problem both at the local and the national level. In analyzing the transportation problem and in reviewing the host of relevant research studies that have been conducted in recent years, one begins to comprehend the complexity of entities, variables, parameters; and measurement problems that characterize the field of transportation. While some studies have sacrificed breadth of coverage in favor of a depth of analysis, other studies have attempted to synthesize several methods into a comprehensive examination of transportation problems. Of interest here is a methodology that features both depth and breadth of analysis. Author (GRA)

N71-16612# Polytechnic Inst. of Brooklyn, N.Y.
RESEARCH OF AEROPHYSICS INSTITUTE FOR STRATEGIC TECHNOLOGY Semiannual Technical Summary Report, Period Ending 31 Aug. 1970
Martin H. Bloom 31 Aug. 1970 16 p refs
(Contract DAHC04-69-C-0077; ARPA Order 1442)
(AD-714286; PIBAL-70-31) Avail: NTIS CSCL 20/4

The report contains a compilation of abstracts of papers which were either accepted for publication or were published. The papers are on subjects of fluid dynamics, electromagnetics and plasmas. The summary also contains a listing of papers submitted to journals, lectures, internal reports and staff activities. Author (GRA)

N71-16873*# George Washington Univ., Washington, D.C.
SCIENTIFIC METHOD, ADVERSARIAL SYSTEM AND TECHNOLOGY ASSESSMENT
Louis H. Mayo Nov. 1970 114 p refs Presented at the Eng. Found. Res. Conf., Andover, N.H., Aug. 1969 Revised *Its* Monograph No. 5
(Grant NGL-09-010-030)
(NASA-CR-116249) Avail: NTIS CSCL 05A

Scientific method and adversarial system as techniques of inquiry in the process of technology assessment are examined. Scientific method is an obvious mode of inquiry with respect to the factual and predictive elements of technology assessment and may have some degree of usefulness even in determining existing and emerging patterns of social interests. Adversarial system, or advocacy in the broad sense, will be utilized in the assessment forum for the purpose of gaining recognition for certain types of effects of given technological applications and persuading the assessment entity to apply evaluative criteria to such effects (in terms of magnitude and social desirability) which will reflect the advocate-participant's preferences. It is concluded that situations of uncertainty as to facts and differences in social value preferences among participants affected by prospective assessment outcomes will inevitably lead to and involve the adversarial system as a technique of inquiry in the process of technology assessment. Author

N71-16874# Defence Documentation Center, Alexandria, Va.
URBAN ECONOMICS AND PLANNING, VOLUME 1 Report Bibliography, Jun. 1962 Mar. 1970
Oct. 1970 292 p refs
(AD-714500; DDC-TAS-70-73-1) Avail: NTIS CSCL 13/2

The bibliography includes annotated references to reports on urban area problems, regional planning and development, sociometrics, urban renewal, transportation, traffic, noise and communications. Corporate author-monitoring agency, and subject, indexes are included. GRA

N71-16884*# George Washington Univ., Washington, D.C. Program of Policy Studies in Science and Technology.
ADVOCACY IN TECHNOLOGY ASSESSMENT
Ernest M. Jones (Florida Univ.) Nov. 1970 80 p refs *Its* Staff Discussion Paper No. 209
(Grant NGL-09-010-030)
(NASA-CR-116250) Avail: NTIS CSCL 05D

The most significant aspects of the contexts in which advocacy respecting technology assessment occurs in legal process are theorized as: participants, perspectives, situations, base values, strategies, outcomes, and effects. Criteria of adequate technology assessment in legal process are proposed respecting each of these contextual aspects, and respecting the problem perception, problem formulation, selection, utilization, determination, and evaluation sequences of internal operations of assessment systems. Finally, the potential contributions of advocacy, conceived both as strategies of claimants and as a mode of inquiry designed into a decisional system, are systematically evaluated with the proposed criteria of adequate assessment. The general conclusion is that criteria of adequate assessment cannot be met without a prominent role for advocacy. Author

N71-16893# Advisory Group for Aerospace Research and Development, Paris (France).
SIXTH AGARD ANNUAL MEETING
6 Oct. 1970 56 p Meeting held at Washington, D.C.
Avail: NTIS

Presentations made at the Sixth AGARD Annual Meeting, to develop general guidelines for future activities and to give the host nation the opportunity to present its aerospace research and development program from the standpoint of the government, industry, and the universities, are reported in full. D.L.G.

N71-16895# National Science Foundation, Washington, D.C.
GRADUATE STUDENT SUPPORT AND MANPOWER RESOURCES IN GRADUATE SCIENCE EDUCATION, FALL 1969. AN ANALYSIS OF STUDENT ENROLLMENTS, SOURCES OF STUDENT SUPPORT, FACULTY, AND POSTDOCTORALS IN DOCTORATE DEPARTMENTS
Sep. 1970 92 p refs
(NSF-70-40) Avail: SOD $1.00

Statistical data are summarized for graduate student support, postdoctorals, and graduate faculty as of fall 1969 in doctorate granting institutions applying for grants from the National Science Foundation for 1970. The graduate enrollment in 2894 science doctorate departments of 224 universities and colleges was distributed as follows: engineering, 28%; social sciences, 20%; physical sciences, 19%; life sciences, 17%; mathematical sciences, 8%; and psychology, 7%. More than 81% of the full-time graduate science students received major financial assistance from outside sources. The U.S. Government financed 37% of the full-time graduate students; institutions and State and local governments, 36%; other sources, such as industry, private foundations, 9%. The remaining 19% relied upon self-support, including loans, savings, and family assistance, to finance their education. A list of institutions participating in the graduate traineeship program statistical tables, instructions and consolidated departmental data sheets, and consolidated departmental summaries are included. F.O.S.

N71-16896# National Science Foundation, Washington, D.C.
RESEARCH AND DEVELOPMENT IN INDUSTRY, 1968. FUNDS, 1968, SCIENTISTS AND ENGINEERS, JANUARY 1969
Marian Mieremet, Robert O. Santos, and John R. Chirichiello Jul. 1970 118 p refs
(NSF-70-29) Avail: SOD $1.00

The results of the 1968 survey of industrial research and

development are presented. Highlights of the report include: (1) In recent years industrial firms have performed about 70% of all research and development in the United States. (2) About 36% of the scientists and engineers in industry were involved in R and D activities in January 1969. Of this 36%, about two-fifths worked on federally financed R and D projects. (3) In 1968, 90% of the $8.6 billion in R and D funds furnished by Federal agencies to industry came from DOD and NASA. DOD funded 104,600 R and D scientists and engineers in 1968, at an average cost of $51,800 per professional. NASA projects averaged $66,000 per scientist or engineer and included 35,000 professionals. (4) The Pacific States accounted for 26% of the industrial total, with $4.6 billion in 1968. Statistical tables showing the distribution of funds are also included. F.O.S.

N71-18697# Ohio State Univ., Columbus. Computer and Information Science Research Center.

REPORT TO THE NATIONAL SCIENCE FOUNDATION OFFICE OF SCIENCE INFORMATION SERVICE, JULY 1969–JUNE 1970

30 Jun. 1970 329 p refs

(Grant NSF GN-5341)

(PB-194790) Avail: NTIS CSCL 05B

The report describes research in eight broad areas of activity: (1) information storage and retrieval; (2) human information processing; (3) information analysis; (4) linguistic analysis; (5) artificial intelligence; (6) information processes in physical, biological and social systems; (7) mathematical techniques; (8) joint program with chemical abstracts service. GRA

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EUROPEAN

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NEW NASA PUBLICATIONS

Recent Advances in Refractory Alloys for Space Power Systems (NASA SP–245)

The proceedings of a June 1969 conference at Lewis Research Center, called to discuss the properties of refractory alloys at temperatures of 2000° F and above in terms of their application in advanced nuclear space power systems. The material was prepared and presented by contractor personnel from information generated under LeRC contracts. The discussions represent a summary of recent advances in the field, covering strength, stability, creep, fatigue, and fabrication, with emphasis on high-strength tantalum-base alloys. *Paperbound.* 304 pp. Available from the National Technical Information Service, Springfield, Va. 22151, for $3.00.

Assessment and Control of Spacecraft Magnetic Fields (NASA SP–8037)

A new space vehicle design criteria publication in the series on structures. This monograph presents NASA's criteria and recommended practices relative to control of magnetic fields arising from sources within a spacecraft. The information is particularly important for spacecraft whose missions involve measurement of natural magnetic fields. The document provides guidance for assessment of magnetic effects and control of adverse effects in spacecraft design, development, and testing. *Paperbound.* 32 pp. Available from the National Technical Information Service, Springfield, Va. 22151, for $3.00.

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